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Daily social interactions and values-consistent behavior in clinical and non-clinical individuals.

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Declaration of authorship

I, Jeanette Villanueva (born January 10, 1990), hereby declare that I have written this dissertation without assistance from third parties who are not indicated. I have not used any other sources in the preparation and writing of this dissertation other than those indicated and I marked all citations. The published or for publication submitted manuscripts have been created in cooperation with the co-authors. The manuscripts have not been published or submitted by any of the co-authors in another place, nor have they been submitted to another examination committee as qualification work. This concerns the following manuscripts:

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Abbreviations

CG	Control group
ESM	Event sampling methodology
GLMM	Generalized linear mixed model
LMM	Linear mixed model
MDD	Major depressive disorder
NA	Negative affect
PA	Positive affect
SP	Social phobia

Abstract

Little is known about patients' daily social interactions, the lack thereof, or their values in daily life. Especially if social areas and affect are concerned, as in patients diagnosed with major depressive disorder (MDD) or social phobia (SP), this merits further investigation. What is valued in daily life can further impact social interactions. What patients value in daily life and to what degree they behave accordingly (i.e., exhibit values-consistent behavior) is currently unknown. Thus, the aim of this thesis was to examine (1) social interactions in relation to affect, (2) having social interactions (proportion, and quality of social interactions) versus *not* having social interactions (wishing for, and avoiding social interactions), and (3) values in daily life. Using event-sampling methodology, participants' daily behavior was sampled in their natural environment. Types of social interactions, negative affect (NA), positive affect (PA), and the quality and avoidance of social interactions were investigated in patients diagnosed with MDD (n = 118) or SP (n = 47), and in a control group (CG, n = 119), while daily values-consistent behavior was examined in transdiagnostic in- and outpatients (n = 100). Results show that the MDD and SP group engaged more often in technological (e.g., phone, Internet) interactions than the CG, which engaged more often in face-to-face interactions. NA was positively associated with technological interactions, whereas PA was positively associated with face-to-face interactions. Compared to the CG, both the MDD and the SP group reported a lower quality of their social interactions, and generally avoided social interactions more often. Both in- and outpatients reported more values-consistent behavior if the behavior was judged as important or if it was embedded in a social context. Findings indicate that the association between technological interactions and NA should be considered when developing or applying clinical technological interventions. Further, understanding what reinforces social interactions in patients might facilitate the incorporation of important and social values into clinical work. This might then increase patients' values-consistent behavior.

Introduction

Social interactions played an essential role in the evolution of humans (Darwin, 1859; Potts et al., 2018). Sometimes, however, if social interactions become chronically distressing, negative sequelae can arise as a consequence. Problematic and sometimes absent social interactions are evident in most mental disorders (American Psychiatric Association, 2000, 2013). Further, the rise of technology might impact humans' social interactions, to the extent that calling or messaging someone might occur more often than actually meeting someone. However, in investigating social interactions, it is important to look beyond the frequency of social contact alone. Research has indicated that the perception of having and not having social interactions is important (Hawkley & Cacioppo, 2010), but more work needs to be done, especially in clinical samples. Further, research is currently incognizant of how important social areas are to patients in their daily life, even though social value domains have been associated with increased values-consistent behavior (Wersebe et al., 2017). In fact, knowledge about what patients value on a daily basis is generally very limited, and knowledge about the importance of the social context and whether patients behave according to their values even more so. Furthermore, the (social) environments of patients differ, depending on whether they are being treated in an inpatient (i.e., hospital environment) or outpatient (i.e., home environment) setting. The importance of the social environment in patients who are currently in therapy is unknown. Since all patients suffer from some functional and/or social impairment, especially regarding daily life (American Psychiatric Association, 2000), investigating patients' daily life carries considerable significance.

Theoretical Background

Social Interactions and Affect in Individuals Diagnosed with a Mental Disorder

Individuals diagnosed with major depressive disorder (MDD) show impairments in their social interactions (e.g., reduced desire to communicate and cooperate in economic

games, problems in understanding the thoughts or feelings of others) and deficits in performing social roles, possibly leading to stigma and social withdrawal (Kupferberg, Bicks, & Hasler, 2016). Individuals diagnosed with social phobia (SP) avoid and have a strong fear of social situations, which might lead to social withdrawal and impairment in social and other areas of functioning (Rapee & Spence, 2004).

Generally, there is a strong drive within humans to establish and preserve meaningful social relationships (Baumeister & Leary, 1995). Difficulties in social interactions might possibly contribute to less meaningful social interactions (e.g., through avoidance of eye contact in patients suffering from SP; Howell, Zibulsky, Srivastav, & Weeks, 2016). It is nevertheless possible that patients consider a social interaction as meaningful even if they "fail to perform." Therefore, investigating *meaningful* social interactions is imperative.

Different types of social interactions. Social interactions can be seen as existing on a continuum of information availability: Whereas the information available in "real life" face-to-face interactions is undoubtedly the richest (e.g., hearing/seeing each other, facilitated emotion conveyance), other social interactions supported by modern technology (i.e., technological social interactions, such as phone or Internet/chat interactions) provide less information, this being especially true for online communication (Schulz & Hoyer, 2016).

Patients diagnosed with depression perceive their face-to-face social interactions as less positive and less enjoyable (Nezlek, Hampton, & Shean, 2000), and use negative emotion words more often in their everyday social behavior (Baddeley et al., 2012), which increases negative communication behavior also from the interaction partner (Rehman, Gollan, & Mortimer, 2008). For individuals diagnosed with SP, the fear of negative evaluation by others is ubiquitous (Kashdan & Farmer, 2014; Rapee & Heimberg, 1997). By definition (*Diagnostic and Statistical Manual of Mental Disorders*, 4th ed., text rev.; *DSM-IV-TR*) they view most social interactions as stressful and anxiety provoking, especially in social situations with

unfamiliar people and/or possible scrutiny (American Psychiatric Association, 2000). Patients diagnosed with SP are more likely to interpret social interactions in a negative fashion and to catastrophize even mildly negative or ambiguous social interactions (Stopa & Clark, 2000). This leads to an increasingly negative view of the social world (Spence & Rapee, 2016). Hence, non-face-to-face communication might reduce worrying about negative evaluation from others (Ybarra, Alexander, & Mitchell, 2005; Yen et al., 2012). Indeed, people with higher anxiety levels were shown to use online interactions or text messaging more often than people with lower anxiety levels (Pierce, 2009).

New technologies such as the Internet or mobile phones might facilitate the avoidance of face-to-face communication (Nie & Erbring, 2002). Anxiety is decreased in online environments (Ybarra et al., 2005; Yen et al., 2012), where meeting new people can be less threatening than face-to-face interactions (McKenna & Bargh, 1999), which thus may be avoided. However, Internet use has also been associated with depression and anxiety: A review found that 75% of the studies linked pathological Internet use with depression and 57% with anxiety (Carli et al., 2013). Despite these insights, it remains unknown whether individuals with MDD or SP choose types of social interactions other than face-to-face more often than nonclinical individuals.

Positive and negative affect. Higher levels of negative affect (NA) and lower levels of positive affect (PA) are correlated with both depression and anxiety (e.g., Watson, Clark, & Carey, 1988). Social interactions are further associated with NA and depressive symptoms (Steger & Kashdan, 2009). However, much research has focused on face-to-face interactions only (e.g., Clark & Watson, 1988) in association with NA and PA. Hence, it remains to be investigated whether technological types of social interactions (phone or Internet/chat) are associated with differing levels of affect. Further, research to date has mostly focused on trait affect (i.e., broad and stable individual predispositions), while the naturally occurring

fluctuations of state affect (i.e., momentary fluctuations in mood, which can be caused by multiple factors; e.g., Brondolo et al., 2008; Watson & Clark, 1984) are poorly understood.

The Presence and Absence of Social Interactions

Examining when people have or do not have social interactions is especially important in highly prevalent disorders such as MDD or SP (Kashdan, McKnight, Richey, & Hofmann, 2009). Although in these patients, strain on the social network is common (American Psychiatric Association, 2000; Baddeley et al., 2012; Beekman et al., 2002) and patterns of social withdrawal and difficulties in social interactions are characteristic (Beidel, Rao, Scharfstein, Wong, & Alfano, 2010; Segrin, 2000), the importance of the quality of social interactions in patients suffering from SP remains to be examined. How social interactions are perceived, including pleasantness (Downie, Mageau, & Koestner, 2008) or intimacy (Downie, Mageau, & Koestner, 2008), might be impacted in patients suffering from depression or SP.

Further, research has been conducted on general loneliness and social isolation (e.g., Hawkley & Cacioppo, 2010), however, in this thesis, specific instances of when people have *no* social interactions are of interest. Research on nonclinical samples has documented that community adults felt happier when they were with other people than when they were alone (Kashdan & Collins, 2010). However, social interactions putatively involve uncomfortable aspects for patients with MDD and SP. Given this point, it is unclear whether individuals with MDD or SP actually wish for more social interactions when they are alone. Furthermore, the social behavior in individuals with either depression or SP has an effect on others, which often leads to these individuals themselves being avoided as interaction partners (Steger & Kashdan, 2009). Yet, it is unknown, to what extent patients themselves actively avoid social interactions.

Values of In- and Outpatients in Daily Life

Across all *DSM* categories, symptoms must cause a clinically significant impairment in functioning (American Psychiatric Association, 2000). Patients' everyday lives, therefore, are

presumably distinguishable from those of individuals without a diagnosis (American Psychiatric Association, 2000; Kupferberg et al., 2016). However, there is a lack of fine-grained data about how daily routines are implemented and where functioning is impaired. Whereas symptoms capture part of the impairment, they do not reveal how well patients navigate through other aspects of life. The omnipresence of the impairment in functioning across all *DSM* categories suggests further investigating a broad swath of diagnoses is needed.

Impairment in functioning often concerns social areas of life. Social areas also impact daily life indirectly in the form of adverse events, such as a divorce (Keller & Nesse, 2006). A divorce can lead to social bonds being lost. Loss of social bonds, in turn, affects daily life and, in more severe cases, also daily functioning (Keller & Nesse, 2006). Despite social support being an important buffer regarding mental health disorders (Rubin & Stuart, 2018), it is unknown how important patients perceive daily social interactions to be. Given that problematic social interactions are often part of the clinical picture in many mental disorders (American Psychiatric Association, 2000), it is rather surprising how little is known about how important everyday social interactions are to patients. Additionally, it is important to capture the context in which daily life happens. A hospital's social environment may thus have different relevance for inpatients and outpatients (Campos Andrade, Lima, Pereira, Fornara, & Bonaiuto, 2013). Therefore, it is essential to consider the treatment setting to account for differences in the social contexts the respective patients are in.

Social context seems to be important in regard to what people value. While social-value domains have been associated with increased values-consistent behavior, compared to non-social-value domains (Wersebe et al., 2017), perceiving something as important and behaving according to that value (i.e., an aspect of life that carries specific importance to a person) are two different things. On the behavioral level, this means it is not only important to know what people value but also whether people act according to what they value. In patients, there is a

discrepancy between values and behavior (Čolić et al., 2019; Hoyer, Čolić, Grübler, & Gloster, 2019), which can prevent people from leading a meaningful life (e.g., Hayes, Luoma, Bond, Masuda, & Lillis, 2006). However, what factors are associated with a decreased discrepancy between values and behavior remains to be seen.

Research Questions

In this context, the following questions were addressed: (1) Are daily social interactions associated with state affect, and does this association differ in patients diagnosed with a mental disorder compared to nonclinical individuals? (2) How do patients diagnosed with a mental disorder experience having social interactions versus not having any social interactions, compared to nonclinical individuals? (3) What contributes to values-consistent behavior in daily life, and does the respective treatment setting make a difference? The following specific research questions were investigated in Manuscripts 1–3 (see Appendices A–C).

Manuscript 1: *Social Interaction in Major Depressive Disorder, Social Phobia, and Controls: The Importance of Affect*

- Do patients diagnosed with MDD or SP engage in different types of social interactions compared to a control group (CG)?
- Is state PA and/or state NA associated with different types of social interactions?

Manuscript 2: *To Be (Alone) or Not to Be: Having Versus Not Having Social Interactions in Patients Diagnosed with Major Depressive Disorder or Social Phobia and Controls*

- When patients *have* social interactions: Do the proportion and quality of social interactions differ when comparing patients diagnosed with MDD or SP to a CG?
- When patients do *not have* social interactions: Do the extent to which patients diagnosed with MDD or SP wish for a social interaction and the extent to which they avoid social interactions differ compared to a CG?

Manuscript 3: *The Everyday Lives of In- and Outpatients when beginning therapy: The Importance of Values-Consistent Behavior*

- Does the importance or the context (social vs. nonsocial) of a valued behavior impact patients' values-consistent behavior?

Methods

Intensive Longitudinal Study Design

All three manuscripts are based on two quasi-experimental, intensive, longitudinal studies with a 7-day event sampling methodology (ESM) phase. During this ESM phase, participants were asked to carry a study-issued smartphone, provided by the research team for data security reasons. For more details on both studies and exact procedures, please see Gloster et al., 2017 (for Manuscripts 1 and 2) and Villanueva et al., 2019 (for Manuscript 3). This study design allowed for the examination of participants' natural motivations, choices, and experiences as they occurred in daily life. Thus, ecologically valid and more accurate data could be collected while capturing dynamic changes in variables. In addition, since human memory is subject to recall bias (Myin-Germeys et al., 2018), the implementation of ESM also reduced the effect of recall bias through real-time data collection (Gloster et al., 2008).

Samples

For Manuscripts 1 and 2, the same sample consisting of individuals diagnosed with MDD (n = 118) or SP (n = 47) and individuals without a diagnosis of MDD or SP (CG; n = 119) was investigated. Participants were recruited from treatment centers (university clinics and cooperating local practitioners) in Switzerland and Germany; recruitment of the CG occurred via local advertising. This study aimed at, among other goals, investigating characteristics of social interactions (Gloster et al., 2017). All participants completed informed consent procedures. The majority of the participants were female (n = 66.5%), with a mean age of 31.75 years (SD = 11.52, range: 18 to 63 years). Consistent with the demographics of this

region, the entire sample was Caucasian. The groups were matched for age and sex. Inclusion criteria were age (18–65 years), diagnostic groups having a *DSM-IV-TR* primary diagnosis of MDD or SP, and the CG having no current *DSM-IV-TR* primary diagnosis of MDD or SP. Exclusion criteria included acute suicidality, current substance dependence, inability to understand the local language, and physical disabilities preventing participation (e.g., an inability to see text on a smartphone or to hear the smartphone's signal).

For Manuscript 3, participants (inpatients, $n = 43$; outpatients, $n = 57$) were recruited from two specialized clinics (inpatient and outpatient) in Switzerland during ongoing referral and intake procedures. The mean age was 34.45 years ($SD = 11.88$, range: 18 to 65 years), and 52% of the participants were female. Participants represented a subset of patients recruited for a larger ongoing study on transdiagnostic treatment for nonresponding patients (see Villanueva et al., 2019). Inclusion criteria were minimum 18 years of age, ability to speak German sufficiently, present for therapy and ability to attend sessions, and signing an informed consent statement. Exclusion criteria were acute suicidal intent, acute substance dependency, active mania, and inability to read or complete assessments. Otherwise all diagnoses were included. Participants presented with the following disorders: affective disorders (35.45%), phobias and other anxiety disorders (37.79%), obsessive-compulsive disorders (13.30%), somatoform disorders (6.43%), impulse control disorders (3.97%), and attention deficit hyperactivity disorder (0.94%). When participants entered the clinic, medication was optimized when necessary, as determined by the attending physician in consideration of patient preference.

Measures

Diagnoses. In all the manuscripts, diagnoses were assessed using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). The SCID-I (current diagnosis) has moderate to excellent values for reliability and validity (DeFife & Westen, 2012; First & Gibbon, 2004; Lobbestael, Leurgans,

& Arntz, 2011). Diagnoses were rated on the Anxiety Disorders Interview Schedule severity rating scale (Brown, DiNardo, & Barlow, 1994). The primary diagnosis (i.e., the diagnosis with the highest severity score) determined group assignment in Manuscripts 1 and 2 (MDD, SP, or CG).

ESM. Data were collected six times per day through a signal-contingent ESM method every 3 hours (e.g., 8 a.m., 11 a.m., 2 p.m., 5 p.m., 8 p.m., and 11 p.m.), covering the time participants were awake. Questionnaires included disorder-specific and transdiagnostic/supplemental items. Participants reported on aspects of their daily life, such as the percentage of time since the last reminder during which they had experienced a certain feeling, symptom, or event. Everyday banalities certainly are part of daily life, and through explicitly examining meaningful social interactions and behaviors, we attempted to exclude these banalities. All ESM items were chosen a priori and adapted to the smartphone context, including an indication of the time frame since the last reminder ("Since the last beep, […]"). ESM items were partly self-developed, partly taken from previous ESM studies (Brown, Strauman, Barrantes-Vidal, Silvia, & Kwapil, 2011; Kashdan & Steger, 2006; Watson, Clark, & Tellegen, 1988), and partly taken from the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988); they reflected core components of affect (e.g., Feldman Barrett & Russell, 1998) and were based on a functional analysis of social interactions (Hanley, Iwata, & McCord, 2003) because of the individual nature of such interactions.

ESM items.

Social interactions and affect. For Manuscript 1, participants reported the number of meaningful social interactions since the last reminder and how the social interaction happened ("face-to-face," "phone," "Internet/chat," or "other," to categorize the type of social interaction). State affect was measured using four items for NA ("Since the last beep, what percentage of the time were you… sluggish?" / "sad?" / "anxious?" / "upset?") and five items

for PA ("Since the last beep, what percentage of the time did you feel… relaxed and rested?" / "enthusiastic?" / "happy?" / "content?" / "grateful?"). Those items were included to assess core components beyond the PANAS and in keeping with a similar study (Kashdan & Steger, 2006).

The presence and absence of social interactions. For Manuscript 2, participants reported the number of meaningful social interactions since the last reminder. If the participant *did* have a meaningful social interaction, items inquiring about its quality followed ("Did you perceive the interaction as pleasant?" rated on a scale of 0–100 [*unpleasant* to *pleasant*], and "How would you estimate the level of intimacy of the interaction?" rated on a scale of 0–100 [*not intimate* to *intimate*]). If the participant *did not* have a meaningful social interaction, items inquiring about the extent to which the participant had wished for a social interaction ("Did you wish for a social interaction?" No, Yes) and the extent to which the participant had avoided a social interaction ("Did you avoid a social interaction?" No, Yes) followed.

Values-consistent behavior of transdiagnostic in- and outpatients. For Manuscript 3, participants were asked about their values, identified the most important valued behavior, and were asked about the degree to which they behaved accordingly (i.e., values-consistent behavior) from one time point to another. Participants reported on multiple aspects of their behavior: First, they were asked about their *plans and intentions* ("What is the most important thing you *are going to do* in the next three hours?"). They were asked to categorize it into one of 11 value domains (to determine how often each value domain occurred). Participants could choose only one domain; choosing none or more than one was not possible. Second, in the next questionnaire 3 hours later, they were asked about their *past behavior* ("What *was* most important to you in the last three hours?") and asked to categorize it into the same 11 value domains. The degree to which the *planned* behavior of one questionnaire and *past* behavior of the following questionnaire occurred in the same domain was the basis for the categorization of consistent versus inconsistent behavior. Consequently, only the 8 a.m. questionnaire was not

comparable to a preceding questionnaire, and the 11 p.m. questionnaire was not comparable to a following questionnaire because in both cases patients were assumed to be asleep. Third, they were asked about the importance of the *past* valued behavior: "To what degree did you really want to spend your time like this?" and "To what degree does this behavior correspond to the way you want to live your life?" Both items were rated on a scale of 0 (*not at all*) to 100 (*very much*). We subsequently dichotomized domains into social and nonsocial domains to investigate patients' consistent behavior in social versus nonsocial domains.

Statistical Analysis

ESM studies rely on repeated measures with interdependent observations of data nested within individuals. To properly address this data structure, multilevel analyses were applied (Raudenbush & Bryk, 2002) using generalized linear mixed models (GLMMs). Multilevel models consider the variability of ESM-based measures within subjects, unequal group sizes, and missing data. GLMMs are therefore appropriate for analyzing data collected from ESM studies. In all three manuscripts, data were included in the analyses if a participant answered more than 50% of the smartphone reminders. Effect sizes are reported as odds ratios and confidence intervals using Wald statistics for GLMMs or β weights and standard errors for linear mixed models (LMMs). Data were analyzed using R 1.2.1335 (R Core Team, 2013).

In Manuscript 1, we analyzed the association between types of social interactions and diagnostic group, and types of social interactions and state affect by implementing binomial GLMMs. Type of social interaction (dichotomous, yes/no) served as the outcome, while diagnostic group (MDD, SP, or CG), and state affect (NA or PA) served as statistical predictors. MDD and SP were combined to one group in a first step (i.e., MDD+SP as one statistical predictor) before being analyzed separately (MDD and SP as separate statistical predictors). Interaction effects between type of social interaction, diagnostic group, and affect were calculated in separate models.

For Manuscript 2 we analyzed differences between the diagnostic groups (MDD, SP, or CG) regarding the proportion and quality of social interactions and the level of wishing for and avoiding social interactions. Proportion of social interactions (dichotomous, occurred/did not occur), wishing for a social interaction (dichotomous, yes/no), and avoiding social interactions (dichotomous, yes/no) were the outcomes in binomial GLMMs, due to their dichotomous scales. Quality of social interaction (0–100) was the outcome in an LMM, due to its continuous scale. For all models, the statistical predictor was diagnostic group.

For Manuscript 3 we examined the association between values-consistent behavior and its importance, and values-consistent behavior and its context (social vs. nonsocial) in transdiagnostic in- and outpatients. For all models, values-consistent behavior (dichotomous, yes/no) of participants served as the outcome in binomial GLMMs. Statistical predictors were importance and context of the behavior. Interaction effects between importance or context of the behavior and treatment setting (in- vs. outpatient) were calculated in separate models.

Results

Types of Social Interactions and Affect

Results of Manuscript 1 suggest three main findings: First, results showed that the combined group (MDD+SP) engaged less often in face-to-face social interactions and used their phones more often for social interactions across the whole week, compared to the CG. There was no difference in Internet/chat interactions between the diagnostic groups and the CG. Second, patients diagnosed with MDD reported a higher frequency of social interactions via their phones than participants in the CG, while there was no difference between the SP group and the CG. Third, across all groups, higher levels of NA were associated with participants engaging in more technological social interactions and fewer face-to-face social interactions. Higher levels of PA were associated with participants engaging in fewer technological social interactions and more face-to-face social interactions. There were no

interactions between the diagnostic groups and NA/PA for any type of social interaction, except between PA and MDD for phone interactions. For detailed results, see Appendix A.

The Presence and Absence of Social Interactions

Results of Manuscript 2 suggest two main findings: First, when participants *had* meaningful social interactions, both diagnostic groups (MDD and SP) reported them to be of lower quality than those reported by the CG. The SP group reported an even lower quality than the MDD group. However, the three groups did not differ in the general proportion of social interactions. When participants did *not* have any meaningful social interactions, both diagnostic groups (MDD and SP) reported a higher level of avoiding social interactions than the CG, but did not differ from each other. Diagnostic groups did not differ from the CG regarding the level of wishing for a social interaction. For detailed results, see Appendix B.

Values-Consistent Behavior of Transdiagnostic In- and Outpatients

Results of Manuscript 3 suggest three main findings: First, in- and outpatients identified different value domains as important. Inpatients reported interacting with others, physical activity, and (marginally) enjoying/relaxing as being important more often than outpatients. Outpatients reported working/studying, media usage, and (marginally) household as being important more often than inpatients. Second, outpatients generally reported behaving more values-consistent than inpatients. Third, both groups reported more values-consistent behavior if the behavior was judged as important, and more values-consistent behavior if the behavior was embedded in a social context. For detailed results, see Appendix C.

Discussion

Even though face-to-face social interactions were crucial in the evolution of humans (Darwin, 1859; Potts et al., 2018), today many interactions happen through technology (Kross et al., 2013), potentially also impacting our affect. While research is incognizant of how this manifests in patients with known difficulties in social areas, such as MDD and SP, it is also

incognizant of times when clinical and nonclinical individuals do not have social interactions in their daily life. Moreover, knowledge about patients' values in daily life is limited, as is knowledge about whether patients behave according to their values, or how important social interactions are in patients' daily lives. This is important, since values are guiding principles that shape people's lives, through big life decisions but also through daily life decisions, and are often also influenced by a person's social context (Roccas & Sagiv, 2010). This thesis demonstrates how social interactions are implemented and experienced by clinical and non-clinical individuals, and how important social interactions are to patients, in addition to what they value in their daily life in general.

Technology, Affect, Quality of Social Interactions, and Avoidance of Social Interactions in Context: A Vicious Cycle?

Patients engaged more often in technological interactions and less often in face-to-face interactions across the whole week compared to the CG. This is not surprising, given that patients with MDD and SP experience higher NA during face-to-face interactions (Baddeley et al., 2012; Kashdan & Farmer, 2014), and especially since social anxiety patients prefer their phone for contact (Reid & Reid, 2007) and experience social contexts online as more liberating than those offline (Schulz & Hoyer, 2016). However, in contrast with previous research, the second finding suggested an association between technological social interactions and NA, and between face-to-face interactions and PA, across all three groups. This discrepancy might be due to our associations being found within a 3-hour time window. This could imply that either (1) some types of social interaction may impact affect or (2) affect may impact the choice of a specific type of social interaction. First, a social interaction might elicit different states of affect. Technological interactions are possibly associated with a certain frustration, which may lead to increased NA (e.g., interacting through technology although a face-to-face interaction would have been preferred, and even though social contexts online might be experienced as

more liberating; Schulz & Hoyer, 2016). Second, state affect might impact the choice of face-to-face versus technological interactions. Participants may have tried to avoid NA (Kanter, Busch, Weeks, & Landes, 2008), which can be elicited by face-to-face interactions, and thus increased their technological interactions. Therefore, technological interactions might serve as a safety behavior.

Zooming out further and incorporating the findings of Manuscript 2—both diagnostic groups reporting a lower quality of social interactions and a higher level of avoiding social interactions, compared to the CG—a vicious cycle might emerge: Patients with depression exhibit increased NA after social interactions (Booij, Snippe, Jeronimus, Wichers, & Wigman, 2018) and tend to hold a negatively biased perception of themselves and others (Zabag, Bar-Kalifa, Mor, & Gilboa-Schechtman, 2018), which might possibly lead to social interactions being evaluated as of lower quality (Manuscript 2). Perceiving their interactions as of low quality might lead to a desire to avoid face-to-face interactions (Kanter et al., 2008), for example, through using technology (Manuscript 1). Therefore, technological interactions might serve as a safety behavior, to avoid face-to-face interactions. However, this avoidance (or safety behavior) leads to patients not experiencing reinforcing aspects of social interactions (Kanter et al., 2008). Technological interactions might then be associated with increased NA (Manuscript 1). Further, both clinical groups (MDD and SP) avoided social interactions more often compared to the CG (Manuscript 2). It is possible that patients specifically avoided face-to-face interactions by increasingly engaging in technological interactions. Moreover, if patients believe their social interactions to be of low quality, there is also less reason to expect high-quality social interactions in general. If such thoughts turn aversive, this may evoke behavior to avoid and escape them (Kanter et al., 2008). An illustration of this potential vicious cycle is shown in Figure 1. The association between PA and face-to-face interactions might similarly fit into a "virtuous" cycle: Experiencing PA after a social interaction may lead to

perceiving the interaction as high quality, leading to more face-to-face interactions, which may in turn generate more PA.

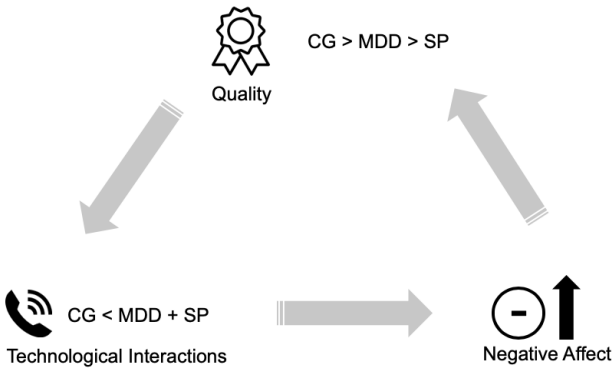

Figure 1. Illustration of a potential vicious cycle involving technological interactions, affect, and the quality of social interactions. Increased negative affect (NA) may lead to perceiving one's face-to-face interactions as of lower quality (in the case of patients diagnosed with major depressive disorder [MDD] or social phobia [SP]), which in turn may lead to increased technological interactions. However, results of Manuscript 1 suggest that technological interactions are associated with increased NA, therefore possibly starting the vicious cycle anew. CG: Control group.

Further, this potential vicious cycle might prevent in- and outpatients alike from pursuing what is important to them. Our results suggest that higher probability of values-consistent behavior was associated with behaviors that are important or social. Moreover, inpatients behaved less values-consistent than outpatients in general. Inpatients imply more severe symptoms (Campos Andrade et al., 2013), which might prevent patients from knowing what actually is important to them, let alone behaving consistently with those values. Further, a higher probability of values-consistent behavior was associated with a social context. This aligns with previous cross-sectional research showing that valued behaviors in social domains were deemed to be more important than those in nonsocial domains (Wersebe et al., 2017). The present results confirm this earlier finding also in the context of patients' daily lives.

Implications

Technology is increasingly used in the clinic (e.g., computerized cognitive behavioral therapy or Internet-delivered cognitive behavioral therapy; Andrews et al., 2018; Kaltenthaler et al., 2006). In light of the results of Manuscripts 1–3, clinicians using technology in their practice are encouraged to explore whether patients potentially use technological interventions partly to avoid face-to-face interactions, in addition to using them in a therapeutic context. While patients should certainly be encouraged to seek treatment (technological or face-to-face), preventing technological interventions from potentially being used as a safety behavior should be addressed in future studies. If technology is indeed used as a safety behavior, there might be a lower chance to experience PA during social interactions, while some patients experience more NA in social interactions already (Baddeley et al., 2012) or tend to interpret social interactions in a negative fashion (Stopa & Clark, 2000). Clinicians, therefore, should be aware of a potential vicious cycle. Clinical practice might further consider focusing more strongly on why people engage in social interactions that they might have wanted to avoid. Targeting the pleasantness and/or intimacy of social interactions in psychotherapy could impact the quality of social interactions. Researchers and clinicians might consider exploring variables that contribute to engagement in social interactions. Further, especially in the social context, investigating what contributes to values-consistent behavior in daily life might prove an important target for clinical practice, since it can precede a reduction in suffering (Gloster et al., 2017). The present research therefore contributes to existing knowledge about mechanisms that might maintain or alleviate suffering.

Strengths and Limitations

This thesis has several strengths: (1) Using ESM, today's gold standard (Kraemer, 1992), is crucial in investigating patients' daily life. ESM enables researchers to assess behaviors, experiences, thoughts, and affect in daily life while markedly reducing the risk of

memory bias and being cognizant of individual contexts of participants (Myin-Germeys et al., 2009; Rinner et al., 2019). It thus makes it possible to shed light on patients' daily lives in a way that was previously not possible. (2) This thesis contributes to existing knowledge about clinical specificity. Being based on two diagnostically diverse samples, the results suggest transdiagnostic relevance. Investigating daily social interactions or the lack thereof might reveal potential mechanisms underlying many different diagnoses. (3) Comparing patients and nonclinical individuals in times when they were alone contributes to existing research mainly focusing on loneliness (e.g., Hawkley & Cacioppo, 2010). (4) This is one of the few studies to consider different social environments in different patient populations.

Several limitations should be considered: (1) ESM, albeit the gold standard for capturing real-life behavior in context and the most accurate measure currently available (Kraemer, 1992), is still a self-report measure. Memory bias (Stone, Shiffman, Schwartz, Broderick, & Hufford, 2003) is therefore not entirely eliminated, but it is kept to a minimum. However, ESM provides more fine-grained information about, among other variables, state affect, which can be valuable in therapy (Scollon, Chu, & Diener, 2009). (2) Verification of subjective assessments (e.g., categorization of types of social interactions, meaningful social interactions, or the social or nonsocial context) is difficult. While verification of subjective assessments is technologically possible, for example, through the participant's personal smartphone log, researchers are required to reconcile the verification with concerns of personal privacy and data security.

Perspectives for Future Research

Further investigation of the degree to which technology might serve as a safety behavior merits more attention. Increased engagement in phone interactions in patients might indicate usage of technology as a safety behavior. Clinicians should be aware of a potential vicious cycle. Putative factors contributing to a potential vicious cycle need to be established in future

research. Further, future research might identify what variables reinforce patients' engagement in social interactions. Increasing awareness of what happens when patients do or do not have social interactions will help elucidate potentially exacerbating or maintaining factors of the disorders and/or increase the subjectively perceived quality of social interactions. Further, to verify whether values-consistent behavior was really carried out, future research needs to reconcile this verification process with concerns of personal privacy.

Conclusion

The present thesis provides new insights into the daily social interactions in the natural environment of individuals diagnosed with MDD or SP, transdiagnostic in- and outpatients, and controls. Results imply that potential use of technological interventions partly to avoid face-to-face interactions—in addition to usage in a therapeutic context—needs to be considered. Further, an intervention (through technology or face-to-face) might focus more on pleasantness and/or intimacy of social interactions and their association with the quality of social interactions. Future interventions might also target increasing values-consistent behavior in daily life, in an effort to reduce suffering. To my knowledge, the studies presented in this thesis are among the first to investigate types of social interactions in the context of PA and NA, the general presence or absence of social interactions, and how values manifest in daily life, within patients with an affective disorder or an anxiety disorder and a transdiagnostic sample, using state-of-the-art ESM. Future research should replicate the present findings and examine how social interactions can be supportive rather than burdening, while using technology as support, not as replacement, in the hope that patients might be further enabled to lead a more meaningful life.

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Appendix A (Manuscript 1)

Social Interaction in Major Depressive Disorder, Social Phobia, and Controls: The Importance of Affect

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Social Interaction in Major Depressive Disorder, Social Phobia, and Controls: the Importance of Affect

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Abstract

Objective: Social interactions are crucial to human beings. As technology advances, new possibilities of interaction emerge, bringing both opportunities and risks, especially when interpersonal behaviors are impaired (e.g., depression) or associated with strong fear (e.g., social phobia). The authors investigated whether technological social interactions (i.e., phone and internet/chat) are used equally as often as face-to-face social interactions in participants with mental disorders and in controls and whether differences are associated with unpleasant emotions, that is, whether the association between negative affect (NA) or positive affect (PA) differed by type of social interaction. Methods: The self-chosen social interactions of participants diagnosed with major depressive disorder (MDD) or social phobia (SP) were compared with participants without these diagnoses (control group, CG). Using event sampling methodology (ESM), participants' everyday social behavior was sampled six times per day for one week in their natural environment. Findings/Results: The CG engaged more often in face-to-face social interactions, while participants diagnosed with MDD or SP engaged more often in phone social interactions. Across all groups, there was a positive relationship between NA and the frequency of technological social interactions, and a positive relationship between PA and the frequency of face-to-face social interactions. Conclusions: The propensity to experience higher levels of PA during face-to-face social interactions and NA during technological social interactions is important to consider when selecting and planning social interactions. Clinicians may consider exploring the social interaction patterns of their patients in the light of these findings. Likewise, developers of technological interventions and clinicians using them should consider the potential that technological social interactions may increase NA.

Keywords Social interaction · Major depressive disorder · Social phobia · Affect · Technology

Introduction

Social interactions are integral to humans (e.g., Darwin 1859). Sometimes, however, social interactions are distressing, and when social interaction problems become chronic, negative sequelae are likely. Problematic and sometimes absent social interactions are evident in mental disorders, especially in major depressive disorder (MDD) and social phobia (SP). Individuals diagnosed with MDD show impaired interpersonal behaviors (e.g., a reduced desire to communicate and cooperate in economic games, problems in understanding the thoughts or feelings of others) and deficits in performing social roles, possibly leading to stigma and social withdrawal (Kupferberg et al. 2016). Individuals diagnosed with SP avoid and have a strong fear of social situations, which might lead to social withdrawal and impairment in social and other areas of functioning (Rapee and Spence 2004).

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Different Types of Social Interactions

Social interactions lie on a continuum of information availability (McKenna and Bargh 2000): While the information available in "real life" face-to-face social interactions is undoubtedly the richest (e.g., hearing/seeing each other, facilitated emotion conveyance, direct information from the immediate environment), other social interactions supported by modern technology ("technological social interactions," such as phone or internet/chat social interactions) provide less information, this being especially true for online communication (Schulz and Hoyer 2016). While some emotion conveyance is possible in a phone call or video chat, this is more difficult in text messages and emails and can be misunderstood (Madell and Muncer 2007). This renders the information availability unequal between different types of social interactions, in that phone and internet/chat social interactions provide less information than face-to-face social interactions.

Patients diagnosed with depression see face-to-face social interactions less positively and as less enjoyable (Nezlek et al. 2000), experience more negative affect in social interactions (Baddeley et al. 2012), and use negative emotion words more often in their everyday social behavior (Baddeley et al. 2012), which increases negative communication behavior also from the interaction partner (Rehman et al. 2008). For individuals diagnosed with SP, the fear of negative evaluation by others is ubiquitous (Kashdan and Farmer 2014; Rapee and Heimberg 1997); by definition, they view most social interactions as stressful and anxiety provoking, especially in social situations with unfamiliar people and/or possible scrutiny (DSM-IV-TR, 4th ed., text rev., American Psychiatric Association [APA] 2000). Patients diagnosed with SP are more likely to interpret social interactions in a negative fashion and to catastrophize even mildly negative or ambiguous social interactions (Stopa and Clark 2000). This leads to an increasingly negative view of the social world, which in turn can result in safety-seeking behaviors that can affect the response of others to the individual diagnosed with SP (Spence and Rapee 2016). Hence, non-face-to-face communication might reduce worrying about negative evaluation from others (Ybarra et al. 2005; Yen et al. 2012), and indeed, people with higher anxiety levels use online interactions or text messaging more often than people with lower anxiety levels (Pierce 2009).

New technologies such as the internet or chat might facilitate the avoidance or replacement of face-to-face communication (Nie and Erbring 2002). Anxiety is decreased in online relationships (Ybarra et al. 2005; Yen et al. 2012), which enables participants to meet new people online in a less threatening environment (McKenna and Bargh 1999), even if they are avoidant of face-to-face interactions. However, in a systematic review based on self-report assessment scales, 75% of the studies linked pathological internet use—defined as impaired impulse-control which shares characteristics known from behavioral addiction—with depression and 57% with anxiety (Carli et al. 2013). Compulsive internet use—defined as an addiction to certain online activities which lead to compulsive internet use (Meerkerk et al. 2009)—is also associated with mental health problems in adolescents (Ciarrochi et al. 2016). Despite these insights, it remains unknown whether individuals with MDD or SP choose types of social interactions other than face-to-face more often than nonclinical individuals.

Positive and Negative Affect

Higher levels of negative affect (NA) and lower levels of positive affect (PA) are correlated with both depression and anxiety (e.g., Watson et al. 1988a). PA and some social activities are more strongly related than others: active and informal activities (e.g., eating or drinking with others, parties) were strongly associated with higher PA, while formal and sedentary social events (e.g., club meetings, lessons) were unrelated to PA (Clark and Watson 1988). However, much research has focused on face-to-face social interactions only. Hence, it remains to be investigated whether technological types of social interactions (phone or internet/chat) are associated with differing levels of affect.

Further, the distinction between trait and state affect is important (Levine et al. 2011): trait affect represents broad and stable individual predispositions, while state affect represents momentary fluctuations in mood, which may fluctuate due to daily events, situational characteristics, or other factors (e.g., Brondolo et al. 2008; Watson and Clark 1984). Research to date has mostly focused on trait affect, while the naturally occurring fluctuations of state affect are poorly understood.

Hypotheses

This paper has two main aims: to understand how participants with MDD, SP, and CG engage in different types of social interactions; and whether state affect (PA and NA) influence the frequencies. It was hypothesized first that participants diagnosed with MDD or SP would show a lower frequency of face-to-face social interactions than participants without these diagnoses (control group, CG), whereas participants diagnosed with MDD or SP would show a higher frequency of technological social interactions, i.e., phone and internet/chat not requiring face-to-face contact (Hypothesis 1). Second, it was hypothesized that emotions impact the frequency of the social interactions across the different types of social interaction. The direction of the relationship was not specified a priori for NA (Hypothesis 2a) or for PA (Hypothesis 2b). Third, it was hypothesized that affect (both PA and NA) would interact with diagnostic group status and impact the frequency of social interactions across the different interaction types for NA (Hypothesis 3a) and PA (Hypothesis 3b).

Methods

Participants

Individuals diagnosed with MDD (N = 118) or SP (N = 47) and individuals without a diagnosis of MDD or SP (CG; N = 119) were included. Participants were recruited from treatment centers (university clinics and cooperating local practitioners) in Switzerland and Germany while recruitment of the CG occurred via local advertising. This was done specifically for this study, which, among other aspects, aimed at investigating characteristics of social interaction (Gloster et al. 2017). All participants completed informed consent procedures. The majority of the participants were female (n = 66.5%), with a mean age of 31.75 years (SD = 11.52, range 18 to 63). Consistent with the demographics of this region, the entire sample was Caucasian. The groups were matched for age and sex. On average, 49.30% of the sample was employed (MDD 52.5%; SP 38.3%; CG 57.1%), while 49.26% were unemployed (MDD 46.6%; SP 61.7%; CG 39.5%). Participants also reported on their living arrangement, namely, whether they lived alone (MDD 22.9%; SP 21.3%; CG 30.3%), with their family or partner (MDD 60.2%; SP 55.3%; CG 49.6%), or in another living arrangement (MDD 16.9%; SP 23.4%; CG 20.2%) (Gloster et al. 2017). Inclusion criteria were age (18–65 years), diagnostic groups having a DSM-IV primary diagnosis of MDD or SP, and the CG having no current DSM-IV primary diagnosis of MDD or SP. Exclusion criteria included acute suicidality, current substance dependence, an inability to understand the local language, and physical disabilities preventing participation (e.g., an inability to see text on a smartphone or to hear the smartphone's signal).

Event Sampling Methodology

Investigating the everyday affect and social behavior of the participants in a more valid and accurate manner (Husky et al. 2010) and reducing the effect of recall bias (Stone et al. 2003) required following the participants out of the lab and "into the wild." Implementation of the event sampling methodology (ESM) via smartphones was therefore suitable and useful because data collection occurred in real-time in the natural environment wherever the participant chose to go, and it assessed moods, thoughts, symptoms, or behaviors, which change over time (e.g., Trull and Ebner-Priemer 2009).

Design and Procedure

This was a quasi-experimental, intensive, longitudinal study with a 7-day ESM phase. During this phase of the study, participants were asked to carry a smartphone, which was, for data security reasons, provided by the research team. For more details on the overall study and exact procedures, please see (Gloster et al. 2017).

Assessment

All participants completed the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) (First and Gibbon 2004; Wittchen et al. 1997). At the time of data collection, the SCID-I for DSM-V was not available in the local language; however, there are no major changes in the diagnostic criteria for MDD and SP. Diagnoses were made using the SCID and rated on the Anxiety Disorders Interview Schedule (ADIS) severity rating scale (Brown et al. 1994). The diagnosis with the highest severity score determined the primary diagnosis and thus group assignment. Data were collected six times a day using a signal-contingent ESM method every three hours (e.g., 8 a.m., 11 a.m., 2 p.m., 5 p.m., 8 p.m., and 11 p.m.), covering the time participants were awake. Questionnaires included disorder-specific and transdiagnostic/supplemental items. Participants reported what percentage of time since the last reminder they had experienced a certain feeling, symptom, or event.

ESM items inquiring about social interactions, PA, and NA were all chosen a priori and adapted to include an indication of the time frame since the last reminder ("Since the last beep, […]"). Items were partly self-developed, partly from previous ESM studies (Brown et al. 2011; Kashdan and Steger 2006; Watson et al. 1988b), and partly from the PANAS (Watson et al. 1988b), reflecting core components of affect (e.g., Feldman Barrett and Russell 1998). Three social interaction items were used for the present analysis with the same introduction: "Since the last beep…how many social interactions did you have?" / "…how many of those social interactions were meaningful to you?". The second item was used to determine the number of social interactions. The last social interaction item, "How did the interaction happen?", asked participants to categorize their social interactions into one of four categories: "face-to-face," "phone," "internet/chat," or "other." The category "other" was very heterogeneous and chosen by all groups only up to 6.7% on average and was thus excluded from the analysis. State affect was measured with four NA items ("Since the last beep, what percentage of the time were you… sluggish?" / "sad?" / "anxious?" / "upset?") and five PA items ("Since the last beep, what percentage of the time did you feel… relaxed and rested?" / "enthusiastic?" / "happy?" / "content?" / "grateful?"). Those items were included to assess core components beyond the PANAS and based on a similar study (Kashdan and Steger 2006).

Statistical Analysis

Data collected from ESM studies are repeated measures with interdependent observations of data nested within individuals.

In order to properly address this data structure, and due to the dichotomous outcome (occurrence of social interaction: yes/no), we used generalized linear mixed models (GLMMs). The GLMMs contained a random intercept to account for the dependency among repeated measures.

For the first hypothesis, we compared the frequency of each type of social interaction of the combined diagnostic groups with the CG (i.e., MDD + SP combined vs. the CG), the frequency of each clinical group with the CG (i.e., MDD vs. the CG and SP vs. the CG), and the frequency of the clinical groups with each other (i.e., MDD vs. SP). Second, we compared the frequency of each type of social interaction dependent on state NA (Hypothesis 2a) and state PA (Hypothesis 2b), across all groups. Third, we compared the frequency of each type of social interaction dependent on diagnostic group and state NA (Hypothesis 3a) and state PA (Hypothesis 3b). For this, we investigated the interaction between diagnostic group and affect for each type of social interaction. We split NA/PA into state and trait and treated and investigated both separately. Trait NA/PA was measured by calculating the mean level of NA/PA the participants reported across the whole week. State NA/PA were the observed values, centering on the subject specific means (i.e., the trait values). Hence, NA/PA values below 0 referred to values where participants reported lower NA/PA levels than their average (trait level), and values above 0 referred to values where participants reported higher NA/PA levels than their average, across the week. NA and PA were analyzed in separate models. For each analysis, data were excluded if a participant answered fewer than 50% of the smartphone reminders during the ESM week. Effect sizes are reported as odds ratios using Wald statistics for each variable in each model. Since the focus of this study lies on state affect, only these results are reported. Please see Supplementary Material (Table S2) for the results for trait affect.

Findings/Results

Hypothesis 1: Differences in frequency of different types of social interactions in participants with MDD or SP and the CG

Over the whole ESM week, the CG reported having had *any* meaningful social interaction (regardless of the type of social interaction) 80.4% of the assessment week, while the MDD group reported the same 74.2% of the assessment week, and the SP group reported 72.5%, as calculated by a count of how often participants reported to have had at least one social interaction. An overview of the general absolute and relative frequencies of types of social interactions engaged in for each group are shown in Table S1 of the Supplementary Material. The response rate during the ESM phase amounted to 91.5% across all groups, with no significant differences between the groups. For the summarized results for Hypothesis 1, see Table 1 and Fig. 1.

In order to establish the relationship between different types of social interactions and diagnoses, we first ran a GLMM comparing the CG to the combined diagnostic groups (i.e., MDD + SP) to examine the general frequency of the different types of social interactions. The results showed that the combined diagnostic groups engaged significantly less often in face-to-face social interactions (CG 93.3%; MDD 90.8%; SP 90.4%) and used their phones more often for social interactions (CG 8.1%; MDD 10.9%; SP 13.0%) across the whole week, while there were no statistically significant differences regarding frequency of internet/chat social interactions (CG 7.1%; MDD 7.6%; SP 9.5%). When we divided the combined diagnostic group into patients diagnosed with MDD and patients diagnosed with SP, both groups and the CG reported the same frequency in face-to-face interactions. However, the MDD group reported using their phone significantly more often than the CG. There were no differences regarding internet/chat interactions.

Hypotheses 2a and 2b: Differences in frequency of different types of social interactions depending on state affect

We investigated the relationship between state affect and types of social interactions, regardless of diagnostic group. Across all three groups, higher NA was associated with less face-to-face social interactions and more social interactions through phone and Internet/Chat. Higher PA was associated with more face-to-face social interactions and less social interactions through phone and Internet/Chat. For the summarized results of all outcomes of Hypothesis 2a (NA) and Hypothesis 2b (PA), see Table 2.

Hypotheses 3a and 3b: Interactions between groups and state affect by type of social interaction

We investigated the interaction between diagnostic groups and NA/PA for each of type of social interaction. For NA, the interaction between affect and diagnostic groups did not yield any significant results, for any of the types of social interaction. For PA, none of the interactions were significant either, except the interaction between PA and MDD for phone social interactions. This suggests that, for the MDD group, the probability of phone interactions decreased when the PA of the patients increased, however, not as strongly as for the other groups. For the summarized results of all outcomes of Hypothesis 3a (NA) and Hypothesis 3b (PA), see Table 2 and Fig. 2.

Table 1 Frequencies of social interactions by type between patients diagnosed with major depressive disorder or social phobia and the control group

	Outcome					
	Face-to-face		Phone		Internet/Chat	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
CG vs. MDD + SP combined	0.72 (0.53, 0.97)	0.03*	1.53 (1.10, 2.12)	0.01*	1.14 (0.60, 2.15)	0.68
CG vs. MDD	0.73 (0.53, 1.01)	0.06	1.48 (1.04, 2.11)	0.02*	1.00 (0.50, 2.00)	0.97
CG vs. SP	0.69 (0.99, 1.00)	0.10	1.58 (0.99, 2.52)	0.05	1.50 (0.61, 3.68)	0.37

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$; *OR* odds ratio, *CI* confidence interval, *MDD* major depressive disorder, *SP* social phobia, *CG* control group

Discussion

This study examined patients diagnosed with major depressive disorder (MDD) or social phobia (SP) and a control group (CG) during a one -week intensive longitudinal examination in their natural environment. The results suggest two main findings: First, diagnostic groups (MDD and SP) reported a significantly higher frequency of social interactions via their phones than did the CG. Second, across all groups, when NA was higher, participants engaged in more technological social interactions (i.e., via phone and internet/chat), while they engaged in more face-to-face social interactions when PA was higher.

Frequency of Different Types of Social Interactions by Patients Diagnosed with MDD and SP

In partial contrast to our results, some previous studies found that face-to-face social interactions were associated with higher NA and lower PA in patients diagnosed with MDD (Baddeley et al. 2012; Nezlek et al. 1994) and SP (Kashdan and Farmer 2014). However, if face-to-face social interactions are indeed associated with higher NA and lower PA, this might, theoretically, give patients less reason to engage in face-to-face social interactions in the future, and indeed our results suggest that participants diagnosed with MDD and SP engage in more phone social interactions. These results are partially consistent with other previous studies: participants with depressive symptoms spend less time with other people (e.g., Brown et al. 2011), while social anxiety patients prefer their phone for contact (Reid and Reid 2007) and experience social contexts online as more liberating than those offline (Schulz and Hoyer 2016). Participants with SP also reported the highest frequency of no social interactions since the last reminder relative to participants with MDD or the CG. However, higher levels of loneliness (which are associated with depression [Barger et al. 2014] and social anxiety [Maričić and Štambuk 2015]) were related to reduced engagement in face-to-face and phone social interactions (Jin and Park 2010). While our results indeed suggest reduced engagement in face-to-face social interactions, the opposite was found for phone social interactions.

The CG and the diagnostic groups engaged equally in internet/chat social interactions. One possible explanation

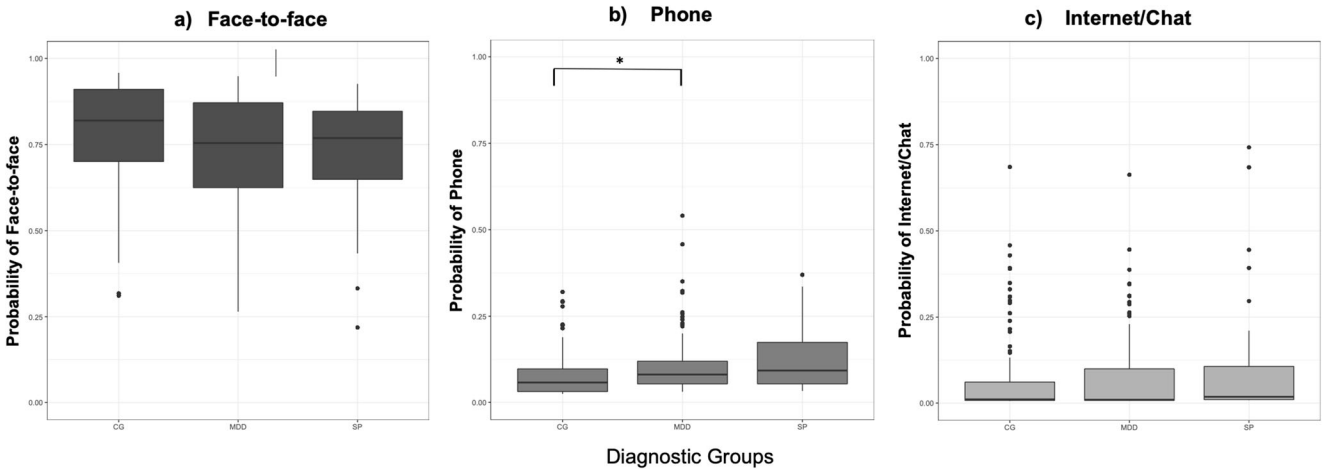

Fig. 1 Differences in engagement in different types of social interaction, depending on diagnostic group (MDD, SP, CG), based on results of the GLMM. The MDD and SP groups used their phones significantly more often than did the CG. CG, control group; MDD, major depressive disorder; SP, social phobia. *$p < 0.05$

Table 2 Frequencies of social interactions by type, depending on diagnosis (major depressive disorder, social phobia) and *negative or positive* affect

			Outcome					
			Face-to-face		Phone		Internet/Chat	
Hypothesis	Groups	Predictor	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
H2a	All	State NA	0.88 (0.82, 0.93)	< 0.00***	1.18 (1.08, 1.28)	< 0.00***	1.24 (1.22, 1.38)	< 0.00***
H2b	All	State PA	1.21 (1.13, 1.30)	< 0.00***	0.77 (0.70, 0.84)	< 0.00***	0.70 (0.62, 0.78)	< 0.00***
H3a	All	State NA × (MDD + SP)	1.03 (0.89, 1.19)	0.68	0.86 (0.70, 1.04)	0.13	1.04 (0.80, 1.35)	0.71
	MDD vs CG	State NA × MDD	1.03 (0.88, 1.20)	0.68	0.83 (0.68, 1.02)	0.08	1.09 (0.83, 1.43)	0.49
	SP vs CG	State NA × SP	1.02 (0.83, 1.26)	0.80	0.93 (0.71, 1.22)	0.63	0.87 (0.61, 1.25)	0.47
H3b	All	State PA × (MDD + SP)	0.98 (0.85, 1.13)	0.84	1.26 (1.03, 1.54)	0.02*	0.93 (0.73, 1.18)	0.56
	MDD vs CG	State PA × MDD	0.99 (0.86, 1.15)	0.94	1.29 (1.05, 1.60)	0.01*	0.89 (0.69, 1.15)	0.38
	SP vs CG	State PA × SP	0.95 (0.78, 1.17)	0.67	1.17 (0.88, 1.55)	0.26	1.05 (0.74, 1.48)	0.76

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$; *OR* odds ratio, *CI* confidence interval, *NA* negative affect, *PA* positive affect, *MDD* major depressive disorder, *SP* social phobia, *CG* control group. Estimates of confidence intervals are based on Wald statistics

might be that misunderstandings are still possible via internet/chat (Madell and Muncer 2007), therefore making a phone social interaction more appealing than the possibly more anonymous internet. Also, a certain communication synchronicity (i.e., speed of information exchange) might be important for participants with MDD or SP. Despite asynchronous information exchange (i.e., slow information exchange, e.g., email), allowing for more time to think than synchronous information exchange (i.e., rapid information exchange, e.g., phone calls, face-to-face) (Madell and Muncer 2007; Münzer and Borg 2008), neither the MDD, nor the SP group seemed to have sought this opportunity. Further, a ceiling effect may be possible: many people use the internet or online communication anyway (Schulz and Hoyer 2016). Eighty-eight percent of the German population used the internet in ("Daily internet usage rate in Germany in 2016, by age group," 2018), as did 85.6% of the Swiss population in ("Internet usage development in Switzerland from October 2008 to March 2017, by frequency," 2018). The internet is omnipresent: while earlier it was only available on a computer, today it is also available on phones.

There are clear differences between the types of social interactions investigated that may help to explain these results: some communicative factors (such as body language, mimics, gestures) are conveyed easier in face-to-face social interactions, while it is harder or impossible to convey them through a phone (Madell and Muncer 2007) or online (Schulz and Hoyer 2016). This information availability also differs regarding positive reinforcers (e.g., a reassuring smile, an occasional nod, in a face-to-face social interaction). While these reactions are valuable in a face-to-face social interaction, it is also noticed quickly if they are missing. This might elicit stronger feelings of doubt and insecurity and even confirmation of worries in participants diagnosed with MDD or SP.

Social Interactions and Affect

Higher state NA was related to fewer face-to-face social interactions and more technological social interactions across all groups. Higher state PA was related to more face-to-face social interactions and fewer technological social interactions across all groups. Earlier research suggests a relation of active or informal social activities to PA (Clark and Watson 1988); however, merely different situations of face-to-face social interactions were investigated. Thus, the present results extend this research by investigating social interactions beyond face-to-face ones and showing an association between lower PA and technological social interactions. The interaction between PA and the MDD group for phone social interactions suggests that the relation between state PA and the probability of engaging in phone social interactions was less negative for subjects with MDD compared to those in CG. This means that while participants with MDD used their phone less when they experienced higher PA, they still used it more often than when the CG experienced higher PA. This might be a consequence of the mood-brightening effect (individuals with depression exhibit an enhanced mood response to positive daily events (Bylsma et al. 2011)). If patients with MDD experienced a phone social interaction as positive, the associated enhanced mood response might lead to them using the phone more often in the future, despite the negative plunge afterwards. This possibly indicates that social interactions precede affect. While this is in line with suggestions by other researchers (e.g., Vranceanu et al. 2009), further studies are necessary to clarify the temporal sequence.

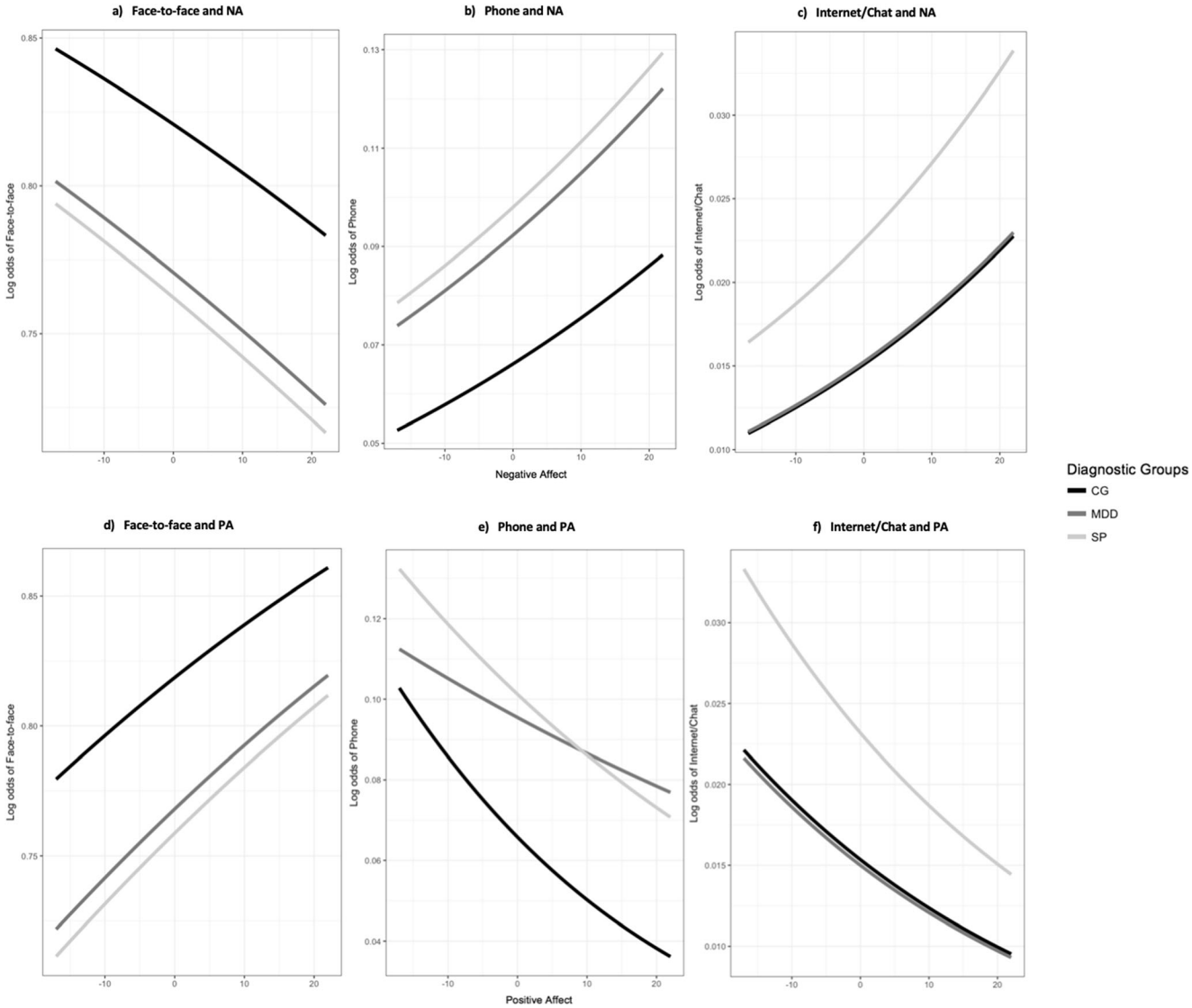

Fig. 2 Differences in engagement in different types of social interaction, depending on diagnostic group (MDD, SP, CG) and state *negative affect and positive affect*, based on results of the GLMM. Panels **a** to **c** correspond to negative affect, panels **d** to **f** correspond to positive affect. The relationships between mean centered state negative/positive affect and the probability of a type of social interaction are depicted on group level (black, medium gray, and light gray lines). The relationships on the group level are all significant ($p < 0.00$). CG, control group; MDD, major depressive disorder; SP, social phobia

Technological Social Interactions and NA, and Face-to-Face Social Interactions and PA

The association between technological social interactions and NA, and between face-to-face social interactions and PA can be interpreted in two ways: First, the type of social interaction might elicit different types of affect. If this is the case, it is possible that a type of social interaction might be associated with a certain frustration (e.g., wanting to see a person face-to-face but only being able to stay in touch with them through technological matters), possibly leading to an increase in NA. Second, affect might impact the selection of type of social interaction. In this case, one interpretation might be that participants try to avoid NA (associated with face-to-face social interactions) and therefore engage more in technological social interactions. While claiming causality is not possible, the latter interpretation seems plausible in the light of MDD patients experiencing social interactions less positively and less enjoyably (Nezlek et al. 2000) and experiencing more NA in social interactions (Baddeley et al. 2012), and SP patients having a strong fear of social situations (Rapee and Spence 2004). A vicious cycle might result in both diagnoses: usage of more negative language, and experiencing more NA (Baddeley et al. 2012), as in depression, and likewise worrying about negative evaluation by others (Kashdan and Farmer 2014; Rapee and Heimberg 1997), thus experiencing higher levels of NA and tending to interpret social interactions in a negative fashion (Stopa and Clark 2000), as in SP might lead

to a desire to avoid face-to-face social interactions. Thus, increased engagement in phone social interactions might serve as a safety behavior. A consequence of this might be increased negative communication behavior from the interaction partner (Rehman et al. 2008) and fewer people wanting to interact with the individual. Therefore, there is also less chance of experiencing PA during social interactions, starting the vicious cycle anew. Nevertheless, regardless of which interpretation is correct, putative factors contributing to these relationships need to be established in future research. Developers of interventions, whether technological or not, and clinicians applying interventions may consider these possible interpretations.

This study is also relevant for clinical approaches, which increasingly use technology in therapy, e.g., computerized cognitive behavioral therapy (CCBT) or internet-delivered cognitive behavioral therapy (iCBT) (Andrews et al. 2018; Kaltenthaler et al. 2006). Considering the present results, technological clinical approaches might want to examine whether patients potentially use technological interventions partly to avoid face-to-face social interactions, in addition to using them as a therapeutic tool. Needless to say, patients should be encouraged to seek treatment, be it through face-to-face or online programs or sessions. However, technological interventions and therapies in general should recognize the importance of helping patients engage in face-to-face social interactions, even if the intervention is based on online programs or sessions. Developers of technological tools must carefully consider the importance of preventing the technological intervention from being used as a safety behavior in future studies.

Additionally, social values tend to be more important to patients compared to other values (e.g., spirituality, recreation, or physical self-care (Wersebe et al. 2017), and increasing values-related behavior precedes a reduction in suffering. Thus, if patients have strong social values and are encouraged to engage more often in those, for instance through more face-to-face social interactions, not only might more PA be a consequence but also a reduction in suffering (Gloster et al. 2017b). Increasing values-related behavior is also related to flexible responding, which helps buffer the impact of stress on social interactions (Gloster et al. under review).

This study had several limitations: First, participants reported considering the time since the last reminder and not how they felt *during* a social interaction. However, ESM (today's gold standard) provided more close-meshed information, including state affect, which can be valuable in therapy (Scollon et al. 2009). Second, the categorization of the technological types of social interactions was subjective. Verification via one's smartphone log is technologically possible. However, we chose to maximize data security by issuing participants a study smart phone. Future research that wishes to use participants own phone would allow such verification. This would require researchers to balance data security issues and participants would need to give researchers access to their personal smartphone. Third, even with this fine-grained data and rich multilevel structure, it is not possible to claim causality, although it is suggested that social experiences are more likely to precede affect than follow it (Vranceanu et al. 2009). Future studies might investigate temporal properties of antecedents and consequences. Fourth, within phone and internet/chat social interactions, there are possibilities of communicating that probably differ in their information availability (e.g., phone calls vs. text messages, anonymous chat rooms vs. Skype calls). However, the focus was on finding potential differences between phone social interactions and internet/chat social interactions generally, as opposed to differences within one type of social interaction. Future studies may include additional items to differentiate text messages and phone calls.

These limitations notwithstanding, this study provides new insights into the social interactions of individuals diagnosed with MDD and SP, also by countering the lack of studies explicitly investigating relationships between clinically relevant social anxiety and online communication (Schulz and Hoyer 2016). To the best of our knowledge, this is the first study to investigate different types of social interactions, combined with different affect states (PA and NA), across a mood disorder, an anxiety disorder, and a CG, hence testing for specificity while also testing the moderating effect of affect. Therefore, this study has practical implications: lower NA levels and higher PA levels might aid the patient to be more open to experiences and situations, possibly leading to a more fulfilling life. Moreover, it also contributes to theoretical knowledge: the association of different types of social interactions with PA and NA might help uncover mechanisms for the maintenance or alleviation of MDD and SP.

Research to date mainly focused on *whether* a social interaction occurred. However, this study shows that *how* a social interaction occurs is equally important: Participants diagnosed with MDD or SP engaged more often in phone social interactions and less in face-to-face social interactions. Across all groups, when PA levels were high, more face-to-face social interactions were reported, while when NA levels were high, more technological social interactions were reported. Despite our advancing technology certainly making many things easier or even possible, at least in terms of affect, our phones and the internet cannot replace real-life interactions.

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Compliance with Ethical Standards

This study was approved by the local ethics committee: EKBB (Ethikommission beider Basel) Number 236/12. Participants all completed informed consent procedures prior to beginning the study.

Conflict of Interest The authors declare that there is no conflict of interest.

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Appendix B (Manuscript 2)

To Be (Alone) or Not to Be: Having Versus Not Having Social Interactions in Patients Diagnosed with Major Depressive Disorder or Social Phobia and Controls

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To Be (Alone) or Not to Be: Having Versus Not Having Social Interactions in Patients Diagnosed with Depression or Social Phobia and Controls

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Abstract

Background: Humans need social interactions, but little is known about the consequences of not having them. This is especially important in patients with known difficulties in social areas, such as those diagnosed with major depressive disorder (MDD) or social phobia (SP). Participants reported on the proportion and quality of social interactions (when they had social interactions) and degree of wishing for and avoidance of social interactions (when they did *not* have social interactions).

Methods: We examined social interactions and the lack thereof in participants diagnosed with MDD or SP and a control group (CG). Using event-sampling methodology, we sampled participants' everyday social behavior 6 times per day for 1 week in participants' natural environment.

Results: Groups differed on the quality and avoidance of social interactions: Participants with MDD and SP reported a significantly lower quality of their social interactions than the CG, with the SP group reporting even lower quality than the MDD group. Further, both the MDD and SP groups reported avoiding social interactions significantly more often than the CG.

Discussion: Although the proportion of social interactions was similar in all groups, the quality of social interactions was perceived to be worse in the MDD and SP groups. It is possible that due to perceiving their social interactions as lower quality, each individual social interaction was less reinforcing for the diagnostic groups, resulting in a vicious cycle. Future research might identify what variables influenced the reinforcement of the MDD and SP groups so that they engaged in the same number of social interactions even though the quality of their social interactions was lower. Increasing awareness of what happens when patients do or do not have social interactions will help elucidate a potentially exacerbating or maintaining factor of the disorders.

Keywords:

social interaction, event-sampling methodology (ESM), major depressive disorder, social phobia, relative rate of reinforcement, quality, avoidance

To Be (Alone) or Not to Be: Having Versus Not Having Social Interactions in Patients Diagnosed with Depression or Social Phobia and Controls

Social interactions played an essential role in the evolution of humans (Byrne & Bates, 2007; Darwin, 1859; Humphrey, 1976; Montepare, 2003; Potts et al., 2018; Skinner, 1984). While the fulfilment of social needs is clearly important for humans (Hawkley & Cacioppo, 2010), it is equally clear that a lack of social contact may lead to negative sequelae. Therefore, both times of having social interactions and times of *not* having social interactions merit scientific attention. While theory indicates that instances of social interactions might be experienced differently, instances of when people have no social interactions are much less explored, especially in clinical samples.

Investigations of social interactions have found, for instance, that in patients with depression, the quantity of social interactions as retrospectively recalled did not differ from that of controls, but they reported their social interactions as being less close or suffering in quality (Baddeley, Pennebaker, & Beevers, 2012; Nezlek, Hampton, & Shean, 2000). Even when the quantity of social interactions was lower in participants with high depressive symptomatology, they also reported their social interactions as being less close (Brown, Strauman, Barrantes-Vidal, Silvia, & Kwapil, 2011). Individuals with depression have been found to have lower social skills, reduced desire to communicate and cooperate, problems in understanding the thoughts or feelings of others, and deficits in performing social roles, possibly leading to stigma and social withdrawal (Beidel, Rao, Scharfstein, Wong, & Alfano, 2010; Kupferberg, Bicks, & Hasler, 2016). In contrast, pleasantness has been shown to be associated with satisfying interpersonal experiences (Downie, Mageau, & Koestner, 2008), and intimacy is associated with social closeness (Bottero & Prandy, 2003). Therefore, the way social interactions are perceived, including how pleasant or intimate a social interaction is, might be impacted in patients suffering from depression. In other disorders, such as social

phobia (SP), a marked and persistent fear of social or performance situations is, by definition, an integral part of the clinical picture (*Diagnostic and Statistical Manual of Mental Disorders*, 4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association [APA], 2000; 5th ed., *DSM-5*; APA, 2013). Individuals suffering from SP may have social skill deficits as well (e.g. difficulties starting or joining a social conversation or have increased expectations of failure in social contexts) (Beidel et al., 2007), which may also impact how intimate or pleasant social interactions are experienced. While SP is associated with a reduced frequency of social interactions (Davidson, Hughes, George, & Blazer, 1993), it nevertheless remains to be seen what role pleasant and intimate social interactions play in patients suffering from SP.

While social interactions have been investigated in patients suffering from depression or social phobia, there is still a need to further explore instances of when people have *no* social interactions. In this context, specific instances of when people have *no* social interactions are of interest, and less states of general loneliness or social isolation (e.g., Hawkley & Cacioppo, 2010). While research has been conducted on general loneliness or social isolation, the investigation of specific instances of when people have *no* social interactions has lagged behind. Research on nonclinical samples has documented that community adults felt happier when they were with other people than when they were alone (Kashdan & Collins, 2010). However, how this plays out in *meaningful* social interactions remains to be seen.

Examining times of having social interactions and times of *not* having social interactions is especially important in highly prevalent disorders such as Major Depression Disorder (MDD) or SP (Kashdan, McKnight, Richey, & Hofmann, 2009), where strain on the social network is common (American Psychiatric Association, 2000; Baddeley et al., 2012; Beekman et al., 2002), and patterns of social withdrawal and difficulties in social interactions are characteristic (Beidel et al., 2010; Segrin, 2000). Studying an affective and an anxiety disorder further allows for clinical specificity (i.e., whether findings are applicable specifically

to one of these diagnoses or to all the groups, which could suggest transdiagnostic relevance). There is a strong drive within humans to establish and preserve meaningful social relationships (Baumeister & Leary, 1995). While difficulties in social interactions might possibly contribute to less meaningful social interactions (e.g. through avoidance of eye contact in patients suffering from SP, Howell, Zibulsky, Srivastav, & Weeks, 2016), it is nevertheless possible that a patient considers a social interaction as meaningful, even if they "failed to perform".

Social interactions putatively involve uncomfortable aspects for patients with depression and SP. Given this aspect, it is unclear whether individuals with clinical diagnoses actually wish for more social interactions when they are alone. Especially if social interactions turn into an aversive experience, patients may attempt to avoid them (Kanter, Busch, Weeks, & Landes, 2008). Due to the more negative and lower quality perception of their social interactions (Baddeley et al., 2012; Nezlek et al., 2000), patients suffering from depression might not expect any close or high-quality social interactions. SP, on the other hand, is by definition characterized by a marked and persistent fear of social or performance situations, in which exposure to and scrutiny by others is possible. This leads to feared social situations being avoided or endured with intense anxiety or distress (*DSM-IV-TR*, APA, 2000; *DSM-5*, APA, 2013). Furthermore, the social behavior in individuals with either depression or SP has an effect on others, which often leads to these individuals themselves being avoided as interaction partners (Steger & Kashdan, 2009). How these relationships can be observed when people have meaningful social interactions versus when they do not, however, is yet to be seen.

Hypotheses

We investigated how *having* meaningful social interactions versus *not having* meaningful social interactions was perceived by patients with a diagnosis of MDD or SP, in comparison to a control group (CG). Overall, we hypothesized (1) that the SP group would report fewer meaningful social interactions in comparison to the MDD group, while the MDD

group would report fewer meaningful social interactions in comparison to the CG and (2) that the quality of meaningful social interactions would be lower in the MDD group, and in the SP group, comparing each group separately to the CG. When participants did *not* have any meaningful social interactions, we hypothesized that the MDD group and the SP group would report (3) a higher level of wishing for a social interaction and (4) a higher level of avoidance of social interactions, comparing each group separately to the CG.

Methods

Participants

Individuals diagnosed with a mental disorder (MDD, $N = 118$; or SP, $N = 47$) and individuals without a diagnosis of MDD or SP (CG, $N = 119$) were investigated. Participants were recruited through local advertising and treatment centers (university clinics and cooperating local practitioners) in [removed for blinding]. The groups were matched for age and sex. The mean age was 31.75 years ($SD = 11.52$, range: 18 to 63 years), and the majority of the participants were female ($n = 66.5\%$). Consistent with the demographics of this region, the entire sample was Caucasian. On average, 49.30% of the sample was employed (MDD: 52.5%; SP: 38.3%; CG: 57.1%), while 49.26% were unemployed (MDD: 46.6%; SP: 61.7%; CG: 39.5%). Participants had either 8-10 years (MDD: 21.1%; SP: 9.3%; CG: 12.0%), 11-13 years (MDD: 51.4%; SP: 67.4%; CG: 53.0%), or 14+ years of education (MDD: 27.5%; SP: 23.3%; CG: 35.0%). Participants also reported on their living arrangement, namely, whether living alone (MDD: 22.9%; SP: 21.3%; CG: 30.3%), with their family/partner (MDD: 60.2%; SP: 55.3%; CG: 49.6%) or in another living arrangement (MDD: 16.9%; SP: 23.4%; CG: 20.2%). Inclusion criterion was age (18–65 years). Exclusion criteria were acute suicidality, current substance dependence, inability to understand [language removed for blinding], and physical disabilities preventing participation (e.g., inability to see text on a smartphone or to hear the smartphone's signal). The number of SP patients that could be feasibly recruited within

the study period was a predefined constraint. Therefore, power calculations were based on between-group comparisons which involve the SP group. The power analyses were based on assumptions of multi-level analyses, assumed alpha = .05, and resulted in power = .8. For more information, please see [reference removed for blinding] for more details.

Design and Procedure

A 7-day event-sampling phase within a quasi-experimental, intensive, longitudinal study was studied. Participants carried a study-issued smartphone during this phase. Measures included in this paper were a subset of those used in the larger study. For further details on the procedure, please see [reference removed for blinding].

Event-Sampling Methodology (ESM)

Understanding participants' social behavior requires data collection in participants' natural environment (Trull & Ebner-Priemer, 2009). Implementing ESM allows the examination of participants' natural social interaction choices and motivations, both when people have social interactions and when they do not. Thus, ecologically valid and more accurate data can be collected while capturing dynamic changes of variables (Husky et al., 2010). Additionally, ESM is suitable and useful for the assessment of moods, thoughts, symptoms, and behaviors which change over time (Ebner-Priemer, Eid, Kleindienst, Stabenow, & Trull, 2009; Trull & Ebner-Priemer, 2009). Since human memory is subject to recall bias (Stone, Shiffman, Schwartz, Broderick, & Hufford, 2003) ESM also reduces the effect of recall bias through real-time data collection.

Assessment

All participants completed the Structured Clinical Interview for *DSM-IV* Axis I Disorders (SCID; Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). We used the SCID-I (current diagnosis), which has moderate to excellent values for reliability and validity (DeFife & Westen, 2012; First & Gibbon, 2004; Lobbestael, Leurgans, & Arntz, 2011). Diagnoses were

rated on the Anxiety Disorders Interview Schedule severity rating scale (Brown, DiNardo, & Barlow, 1994). The primary diagnosis (i.e., the diagnosis with the highest severity score) determined group assignment. ESM data were collected six times a day using signal-contingent ESM every 3 h (e.g., 8:00 a.m., 11:00 a.m., 2:00 p.m., 5:00 p.m., 8:00 p.m., and 11:00 p.m.). We also discussed concepts such as meaningfulness with participants before they started into the ESM data collection week. We indicated that they were to decide what was meaningful and that it need not have a predetermined length or interaction partner. Each participant articulated several situations they considered to be meaningful social interactions. Consistent with the subjective nature of this concept, we emphasized that it was up to them to decide what was meaningful. The purpose of this discussion was to exclude banality. After it was confirmed that there were no questions left, participants entered the ESM phase. During this week participants were asked to report on the occurrence or nonoccurrence of their social interactions since the last reminder. When participants have had any social interactions, items followed about (a) proportion: "How many social interactions were meaningful to you?," dichotomized into none versus more than one and (b) social interaction quality: "Did you perceive the interaction as pleasant?," on a scale of 0–100 (*unpleasant* to *pleasant*), and "How would you estimate the level of intimacy of the interaction?," on a scale of 0–100 (*not intimate* to *intimate*). Based on earlier research ratings of pleasantness and intimacy were combined into a rating representing social interaction quality (Bottero & Prandy, 2003; Downie et al., 2008). When participants did *not* have any meaningful social interactions, items followed about (a) wishing for a social interaction: "Did you wish for a social interaction?" (No, Yes), and (b) avoiding a social interaction: "Did you avoid a social interaction?" (No, Yes). Henceforth, to facilitate the reading of this paper, we refer to patients who did not have had any meaningful social interactions as being "alone." Items were all chosen a priori and adapted to the ESM format used in this study (by adding an indication of the time frame since the last reminder:

"Since the last beep, […]"). Items stemmed from previous ESM studies (Brown et al., 2011; Kashdan & Steger, 2006; Watson, Clark, & Tellegen, 1988) and were based on a functional analysis of social interactions (Hanley, Iwata, & McCord, 2003) due to their individual nature.

Statistical Analysis

Data were included in the analyses if a participant answered at least 50% of the smartphone reminders. Six participants completed less than 50% of ESM time points and were therefore removed from the data set. In consideration of the study design and the structure of the data, the data was analyzed using multilevel models. Multilevel models consider the variability of ESM based measures within subjects, unequal group sizes, and missing data. These models are therefore well suited to analyze data collected from ESM studies, which are repeated measures with interdependent observations of data nested within individuals. Generalized linear mixed models (GLMMs) were therefore implemented for binary outcomes (Hypotheses 1, 3, and 4), and linear mixed models (LMMs) were implemented for continuous outcomes (Hypothesis 2). Calculations were based on a sample of 5,609 instances when participants had social interactions, and a sample of 1,356 instances when participants had no social interactions. The CG was the reference group for models comparing the diagnostic groups (MDD and SP) to the CG. When comparing the diagnostic groups to each other, MDD was the reference group. GLMMs contained a random intercept to account for the dependency among repeated measures. Considering the nested structure of the data set, outcomes were state measures in all models. Each data point of each participant was put in relation to the group (i.e. six scores per day per person). Thus, by avoiding to collapse scores into aggregate variables, using multilevel models allowed for fine-grained analyses.

Additionally, in order to investigate the impact of comorbidity between patients suffering from MDD and SP on the results, each hypothesis was recalculated after re-distributing the participants into four groups to take comorbidity into account: MDD (no

comorbidity with SP), SP (no comorbidity with MDD), both (MDD or SP comorbid with MDD or SP, respectively), and the CG. Results of re-running the analyses are listed under the corresponding hypotheses.

Results

We compared the CG to each of the diagnostic groups (CG vs. MDD, CG vs. SP) and then compared the two diagnostic groups to each other (SP vs. MDD) for all analyses. Overall, participants responded to 92.3% of queried assessments. For the summarized results for Hypotheses 1 to 4 see Table 1 and Figure 1.

[Table 1 here]

[Figure 1 here]

Hypothesis 1 presumed that the SP group would report fewer meaningful social interactions in comparison to the MDD group, which would report fewer meaningful social interactions in comparison to the CG. While the overall proportion of social interactions was rather high in all three groups (CG: 81.2%; MDD: 80.2%; SP: 79.6%), GLMM results indicated that the proportion did not differ between the groups (MDD vs. CG: OR = 0.88, p = .45, 95% CI, [0.61, 1.25]; SP vs. CG: OR = 0.96, p = .84, 95% CI [0.59, 1.55]; SP vs. MDD: OR = 1.09, p = .73, 95% CI [0.68, 1.78]). Re-running the analysis after re-distributing the participants into four groups to take comorbidity into account yielded the following result: MDD vs. CG: OR = 0.94, p = .77, 95% CI, (0.63, 1.41); SP vs. CG: OR = 0.90, p = .73, 95% CI (0.51, 1.62); MDD+SP vs. CG: OR = 0.83, p = .40, 95% CI (0.53, 1.30).

Hypothesis 2 investigated whether the quality of meaningful social interactions would be lower in the two diagnostic groups (MDD and SP) compared to the CG. Results suggest that both MDD and SP participants perceived their social interactions to be significantly lower in quality compared to the CG (MDD vs. CG: β = -7.74, SE = 1.45, p < .00; SP vs. CG: β = -13.01, SE = 1.92, p < .00). Participants in the SP group reported even lower social interaction

quality than participants in the MDD group (SP vs. MDD: β = -5.26, *SE* = 1.93, $p < .00$). Re-running the analysis after re-distributing the participants into four groups to take comorbidity into account yielded the following result: Hypothesis 2: MDD vs. CG: β = -6.17 (1.59), $p < .00$, SP vs. CG: β = -8.87 (2.32), $p < .00$; MDD+SP vs. CG: β = -13.85 (1.78), $p < .00$.

Hypothesis 3 presumed that the diagnostic groups (MDD and SP) would report a higher level of wishing for a social interaction than the CG. Overall, wishing for a social interaction was comparable across groups (MDD vs. CG: OR = 1.23, $p = .48$, 95% CI [0.68, 2.28]; SP vs. CG: OR = 1.75, $p = .16$, 95% CI [0.81, 3.85]; SP vs. MDD: OR = 1.42, $p = .37$, 95% CI [0.65, 3.05]). Re-running the analysis after re-distributing the participants into four groups to take comorbidity into account yielded the following result: MDD vs. CG: OR = 1.52, $p = .36$, 95% CI, (0.61, 3.96); SP vs. CG: OR = 1.06, $p = .93$, 95% CI (0.24, 4.23); MDD+SP vs. CG: OR = 0.86, $p = .78$, 95% CI (0.29, 2.48).

Hypothesis 4 investigated whether the diagnostic groups would report a higher level of avoidance of social interactions in comparison to the CG. Results suggest that both the MDD and SP groups avoided social interactions significantly more often compared to the CG (MDD vs. CG: OR = 2.96, $p = .001$, 95% CI [1.54, 5.86]; SP vs. CG: OR = 3.66, $p = .003$, 95% CI [1.57, 8.74]). Interestingly, there were no differences between the MDD and SP groups (SP vs. MDD: OR = 1.16, p = .73, 95% CI [0.49, 2.76]). Re-running the analysis after re-distributing the participants into four groups to take comorbidity into account yielded the following result: MDD vs. CG: OR = 0.76, $p = .02$, 95% CI, (0.55, 0.90); SP vs. CG: OR = .68, $p = .32$, 95% CI (0.33, 0.90); MDD+SP vs. CG: OR = 0.85, $p = .001$, 95% CI (0.67, 0.95).

Discussion

This study examined participants diagnosed with MDD or SP and a CG during an intensive 1-week longitudinal investigation in their natural environment. Through using ESM to investigate two highly prevalent and relevant clinical groups (MDD and SP) and comparing

them to a CG, we aimed to surmount the limitations of cross-sectional testing in an ecologically valid manner, while simultaneously testing for clinical specificity. Results suggest two main findings: First, when participants *had* meaningful social interactions, the diagnostic groups (MDD and SP) reported a lower quality of meaningful social interactions than controls, with the SP group reporting even lower quality than the MDD group. When participants did *not have* any meaningful social interactions, the diagnostic groups (MDD and SP) reported a significantly higher level of avoiding social interactions than the CG, with the two diagnostic groups not differing from each other. Neither the proportion of meaningful social interactions nor the level of wishing for a social interaction differed between the MDD group, the SP group, and the CG.

Being with someone: Proportion and quality of meaningful social interactions in patients diagnosed with MDD or SP and controls

Given that social interactions are associated with higher negative affect and lower positive affect in patients diagnosed with MDD and SP (Baddeley et al., 2012; Kashdan & Farmer, 2014; Nezlek, Imbrie, & Shean, 1994; Vassilopoulos & Banerjee, 2010), one might expect participants with MDD and SP to show a different proportion of meaningful social interactions compared to a CG. However, our result showed no difference in the proportion of meaningful social interactions between the groups. This is consistent with research showing no differences in the proportion of social interactions in participants with depression compared to controls (Baddeley et al., 2012; Nezlek et al., 1994, 2000) but is in contrast to earlier research showing reduced proportion of social interactions in participants with SP compared to controls (Davidson et al., 1993). Discrepant results regarding the proportion of social interactions might be due to methodology (retrospective self-report during an interview [Davidson et al., 1993] vs. ESM in the present study). Further complicating comparisons with other studies, the present study specifically queried for meaningful interactions, whereas previous studies either did not

differentiate or did not report on whether the social interactions they investigated were meaningful. Despite part of the definition of SP (*DSM-IV-TR*, APA, 2000; *DSM-5*, APA, 2013) possibly leading to an expectation of a lower proportion of social interactions in this group, the definition of SP includes situations that involve scrutiny. The focus of the present study, however, was on meaningful situations, which may or may not have elicited feelings of scrutiny in participants with SP. This constitutes an important point, because patients suffering from SP do not always have phobic social interactions. The current study therefore provides new insights into SP beyond phobic social interactions.

Despite the absence of a difference in the proportion of meaningful social interactions between the groups, both the MDD and SP groups reported significantly lower levels of social interaction quality compared to the CG. This is consistent with previous research showing that patients with depression perceive social interactions as being less close or suffering in quality (Baddeley et al., 2012; L. H. Brown et al., 2011; Nezlek et al., 2000). Again, previous studies not differentiating or reporting on whether the social interactions they investigated were meaningful complicates comparisons with other studies. Multiple processes could contribute to perceiving meaningful social interactions as "lower quality": Patients with depression show negative reactivity specifically after social interactions (i.e., patients display increased negative affect after social interactions; Booij, Snippe, Jeronimus, Wichers, & Wigman, 2018). This, in addition to a tendency of a negatively biased perception of themselves and others (Gara et al., 1993; Zabag, Bar-Kalifa, Mor, & Gilboa-Schechtman, 2018), may possibly lead to a social interaction being perceived as lower quality. There is also a tendency to suppress emotions more in patients with depression, in order to downregulate negative emotions (Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010; Liverant, Brown, Barlow, & Roemer, 2008). This emotion suppression can create a discrepancy between inner self and outer behavior (Gross, Richards, & John, 2006), which can be interpreted as being inauthentic or

disingenuous. A patient suppressing their emotions can therefore potentially be perceived as being inauthentic or less trustworthy (Centorrino, Djemai, Hopfensitz, Milinski, & Seabright, 2015), which may impact the quality of the social interaction. This might be reflected in the perceived quality of social interactions as well. Inauthenticity may inhibit intimacy within the social interaction (which in this study was defined as being part of social interaction quality) because others perceive it and want interpersonal distance.

Interestingly, the SP group reported even lower levels of social interaction quality compared to the MDD group. There might be multiple reasons for this: First, individuals with SP fear specific social situations greatly (*DSM-IV-TR*, APA, 2000; *DSM-5*, APA, 2013) and since fear is rarely experienced as positive, fear might impact the quality of their social interactions. Second, individuals with SP possibly engage more in constant monitoring of threat and anxiety during social interactions, which can disrupt recognition and acknowledgment of rewards during this time (Baumeister, 2002). Constant monitoring might arise due to a tendency to engage more in negative self-referent and self-evaluative thoughts (Lucock & Salkovskis, 1988; Rapee & Lim, 1992; Stopa & Clark, 1993), perceiving the interaction partner as more dominant (Zabag et al., 2018), interpreting ambiguous social events in a negative way and mildly negative events in a catastrophic fashion (Stopa & Clark, 2000), ruminating about possible social failures and possible devaluation by others after social interactions (Clark & Wells, 1995; Kashdan & Roberts, 2007), which maintain distress and negative self-appraisals (Kashdan & Collins, 2010), or seeing social outcomes as information about expectations that others might have, rather than information about one's own competence (Wallace & Alden, 1995). Additionally, the reported social interactions might or might not include performance situations, since we enquired about meaningful social interactions. This is an important point, since fear of situations of possible scrutiny and fear of more general social interactions are different aspects of the disorder (Mattick & Clarke, 1998).

Being alone: wishing for and avoiding social interactions in patients diagnosed with MDD or SP and controls

Rates of time spent alone in our sample (19.5% of the time) were in the scope of other ESM studies (18–24.1%), although those were done with students (Dunton et al., 2007) or community residents (Kashdan & Collins, 2010). Our results showed that neither the MDD nor the SP group wished for social interactions any differently from the CG. On the one hand, this is in contrast to earlier research, indicating that deficits in social functioning (as they are existent in patients with MDD or SP) may decrease the potential to engage in social interactions (Kupferberg et al., 2016). On the other hand, it has been shown in past research that patients perceive their social interactions to be more negative (Baddeley et al., 2012; Nezlek et al., 2000). In the light of this result, patients might not wish for more social interactions because they believe there is no reason to expect any high-quality social interactions, or possibly their social interactions were fulfilling and meaningful as they were. Future research should test both advantageous and dysfunctional antecedents and consequences of being alone to investigate this finding further.

Both diagnostic groups avoided social interactions more often than the CG. Aversive thoughts may evoke behavior to avoid and escape the thought (e.g., avoidance of romantic relationships after a breakup to avoid anxiety and self-referential thoughts; Kanter, Busch, Weeks, & Landes, 2008). It is therefore possible that the MDD group avoided social interactions to avoid social-interaction-related thoughts (Kanter et al., 2008). This avoidance works in the short term but creates more problems in the long term, because patients are not experiencing the reinforcing aspects of social interactions (Kanter et al., 2008). Further, the mood-brightening effect (depressed individuals show greater positive emotional reactivity to positive events than non-depressed individuals, and a larger plunge in terms of mood afterward; Bylsma, Taylor-Clift, & Rottenberg, 2011; Takano, Sakamoto, & Tanno, 2013) might have set

in: Remembering the experience of a plunge in mood after a strong positive reaction to a social interaction might have led them to avoid social interactions more. Participants with SP, on the other side, may have avoided social interactions because the quality of their social interactions was low. Alternatively, the quality of their social interactions might have been low because they habitually avoid them, thus limiting their interpersonal skills.

It is also possible that, because they perceived their social interactions as lower quality, each individual social interaction was thus less reinforcing for the diagnostic groups, resulting in a vicious cycle. Thus, since all three groups reported a comparable proportion, but the diagnostic groups reported a lower quality of social interactions, it cannot be the quality of social interactions alone that had a reinforcing impact on their social interactions, otherwise the proportion of social interactions would have been lower for the diagnostic groups than for the CG (Lewinsohn, 1974). Since these data were collected in the natural environment of each participant, it might well be that some patients simply had no choice but to engage in social interactions, even though avoidance would have been much more desirable for them at that moment. One can avoid only so many social interactions and still be a functioning individual in today's society. Having no choice but to engage in some social interactions might therefore explain why the three groups reported comparable frequencies of social interactions. Further, if having no choice resulted in a feeling of being forced to interact with someone without wanting it, this might have contributed to perceiving their social interactions as lower quality and thus, possibly, as less reinforcing. Possibly a stronger focus on what reinforces or encourages people to engage in social interactions might increase the subjectively perceived quality of social interactions. According to our operationalization of quality of social interactions, interactions that feel more pleasant and more intimate might impact the perceived quality of social interactions. Both clinical work and future research might attempt to identify further variables that contribute to the different relative rates of reinforcement.

Limitations

This study has five main limitations: First, although ESM is the gold standard for capturing real-life behavior in context in part because participants can report their behaviors and feelings more accurately than with questionnaires (Kraemer, 1992), in this case it was still a self-report of self-selected social interactions. Second, participants decided themselves what a meaningful social interaction was, which might have differed across participants. It is difficult to imagine how this component could be standardized, but it is nevertheless important to keep in mind that it was subjective meaningfulness that was assessed. Third, these meaningful social interactions were not defined in terms of valence, and thus a meaningful social interaction could have been associated with negative or positive emotions for a participant. This is especially important in regard to the negative emotional bias of people diagnosed with MDD. Future research might consider varying assessment density by increasing the assessment frequency or including less meaningful or nonmeaningful social interactions to explore whether our findings persist in all social situations. Fourth, the ESM data collection period lasted 7 days. While this period is shorter than some other ESM studies (e.g. Hui & Kogan, 2018), we aimed to keep time and resource burden to a minimum, especially on the side of the patient. Further, we are confident that 7 days suffice to capture occurrences and non-occurrences of often frequently happening events (such as social interactions) and the corresponding thoughts and feelings. Since we captured participants' waking time during every day of the week, there was no reason to believe that extending the data collection period would yield differing results. Fifth, the distribution of the participants to the groups analyzed in this study (i.e., MDD, SP, CG) was based on the primary diagnosis. As described above we have re-run the analysis after re-distributing the participants into four groups to take comorbidity into account. Re-running the analyses yielded only one change to the results: The SP group was now comparable to the CG in terms of avoidance. While we acknowledge this result, it

should be interpreted cautiously, since after re-distribution of the participants the SP group (no comorbidity with MDD) was a sample in essence too small to conduct these analyses in a meaningful way (n = 28). We can therefore state that our results do not change if comorbidity is considered in addition.

Conclusion

The present study provides new insights into social interactions of individuals diagnosed with MDD and SP, and also into the experience of not having meaningful social interactions. Participants were asked about their experiences when *having* a social interaction (proportion and quality of social interactions) and when they did *not have* any social interactions (wishing for and avoidance of social interactions), providing over 10,000 data points and thus enabling us to examine a reliable part of everyday life that cannot be tested by other means. On the one hand, this study has practical implications in that possibly a stronger focus on what reinforces or encourages patients to engage in social interactions, as opposed to avoiding them, might increase the subjectively perceived quality of social interactions, putatively leading to richer and more fulfilling social interactions. On the other hand, it also contributes to theoretical knowledge: Investigating how social interactions and a lack thereof are perceived is an important step in discovering how social interactions contribute to mechanisms that maintain or alleviate MDD and SP.

Social interactions are not always easy. However, if people approach them in such a way that they support rather than burden, they might prove to be helpful in times of need. Contrary to common belief, symptoms do not necessarily need to go away before one can engage in what is important to oneself. Indeed, increased engagement in what is important can precede reductions in a person's suffering [reference removed for blinding]. While digging deeper into what makes a social interaction low or high quality is a question reserved for future

research and clinical work, we propose that learning more about what reinforces engagement in social interactions might contribute to people having more high-quality social interactions.

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Conflict of Interest

The authors have no conflicts of interest to declare.

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List of tables and figures

Tables

Table 1.

Differences in the Proportion and Quality of Experienced Social Interactions, and Differences in the Level of Wishing for a Social Interaction and Avoidance of Social Interactions.

Social interaction experience		**Outcome**	**MDD vs. CG**		**SP vs. CG**		**SP vs. MDD**	
			OR (95% CI) / β (*SE*)	***p***	**OR (95% CI) / β (*SE*)**	***p***	**OR (95% CI) / β (*SE*)**	***p***
Social interactions	experienced	Proportion of meaningful social interactions	0.88 (0.61, 1.25)	.45	0.96 (0.59, 1.55)	.84	1.09 (0.68, 1.78)	.73
		Quality of social interactions	-7.74 (1.45)	**< .00*****	-13.01 (1.92)	**< .00*****	-5.26 (1.93)	**< .00*****
No social interactions	experienced	Wishing for a social interaction	1.23 (0.68, 2.28)	.48	1.75 (0.81, 3.85)	.16	1.42 (0.65, 3.05)	.37
		Avoidance of social interactions	2.96 (1.54, 5.86)	**.001*****	3.66 (1.57, 8.74)	**.003****	1.16 (0.49, 2.76)	.73

Note: OR: Odds ratio; CI: confidence interval; β: Beta coefficient; SE: Standard error; MDD: major depressive disorder; SP: social phobia; CG: control group. ORs and CIs refer to generalized linear mixed model results; β and SEs refer to linear mixed model results. *p*-values in bold writing indicate significant results. $^{**}p < .01$. $^{***}p < .001$.

Figures

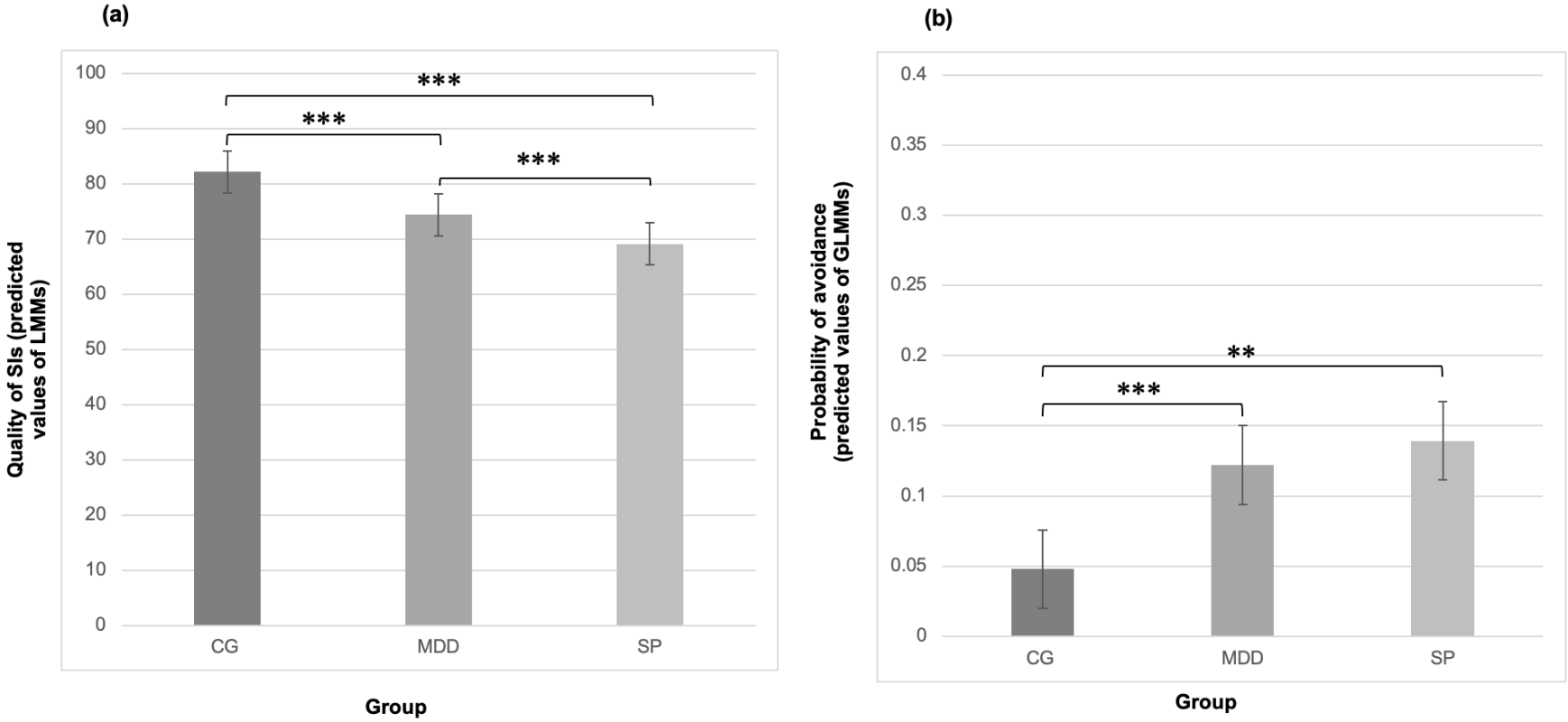

Figure 1. Results of the linear mixed models (LMMs) and the generalized linear mixed models (GLMMs): Differences in (a) quality of social interactions, on a scale of 0–100, and (b) avoidance of social interactions (dichotomous, 0 or 1), depending on group (major depressive disorder [MDD] diagnosis, social phobia [SP] diagnosis, control [CG]). $^{**}p < .01$. $^{***}p < .001$.

Appendix C (Manuscript 3)

The everyday lives of in- and outpatients when beginning therapy: The importance of values-consistent behavior

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The everyday lives of in- and outpatients when beginning therapy: The importance of values-consistent behavior

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Declaration of interest

Declarations of interest: none.

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Abstract

Background: The manifestation of functional impairment in patients' daily lives and interference with things they value is poorly understood. If values are compromised in patients, as theory suggests, social contexts (and the lack thereof) are especially important – though this is currently unexplored. We therefore examined whether daily values-consistent behavior was associated with the importance of a value and whether it involved social or non-social activity. **Methods:** Using event sampling methodology (ESM), we examined daily values-consistent behavior in 43 transdiagnostic inpatients and 57 transdiagnostic outpatients at the beginning of treatment. Patients' values-consistent behavior, its importance, and (social vs non-social) context was sampled six times per day during a one-week intensive longitudinal examination. **Results:** Across both groups, the probability of subsequent values-consistent behavior increased if (1) it was judged as more important by the patient or (2) if it was embedded in a social context. The probability of reporting values-consistent behavior was higher for outpatients than inpatients. **Conclusions:** Clinicians are encouraged examine the values of their patients more closely and to especially monitor *important* and/or *social* values. Incorporating these into clinical work might increase patients' values-consistent behavior, which can play a role in reducing suffering.

Key words (max. 5): Transdiagnostic, Event Sampling Methodology (ESM), consistent behavior, values, quasi-experiment

The everyday lives of in- and outpatients when beginning therapy: The importance of values-consistent behavior

One criterium common to all DSM categories is that symptoms must cause a clinically significant impairment in functioning (American Psychiatric Association, 2000). However, functioning tends to be measured on an abstracted level, e.g. through assessing general working ability or satisfaction with working capacity (Trompenaars, Masthoff, Van Heck, Hodiamont, & De Vries, 2005). Information about how daily routines are implemented or stymied are usually measured retrospectively, while information assessed in a real-time fashion in participants' natural environment is largely missing. As a result, little systematic knowledge exists about the daily lives of patients as they present for treatment (Wersebe, Lieb, Meyer, Hofer, & Gloster, 2018). Patients' everyday lives are assumed to be distinguishable from individuals without a diagnosis. The omnipresence of the impairment in functioning across all DSM categories merits investigating a broad swath of diagnoses. For example, patients diagnosed with obsessive-compulsive disorder spend a substantial amount of time engaging in obsessions and compulsions (e.g. hand washing, ordering, checking) or patients diagnosed with depression who feel worthless or guilty often contribute to impairment in social, occupational, or other important areas of functioning (Kupferberg, Bicks, & Hasler, 2016). Another example are patients diagnosed with agoraphobia, who avoid places or situations from which escape might be difficult or embarrassing or in which help may not be available (American Psychiatric Association, 2000), thereby restricting their travel possibilities. Whereas symptoms capture part of the impairment, they do not inform about factors that exacerbate the functional impairment nor do they indicate when and how they are able to successfully navigate through daily life.

Investigating patients' everyday life also has clinical implications. Daily life is impacted by adverse life events (such as death of a loved one or romantic breakups), which

have been related to more depressive symptoms (Keller & Nesse, 2006). For example, a divorce can lead to social bonds being lost. Loss of social bonds, in turn, affects daily life and, in more severe cases, also daily functioning (Keller & Nesse, 2006). Therefore, regardless of whether stressors occur daily or as major life events, actively engaging in values may have a pivotal effect on subsequent suffering (Gloster et al., 2017).

However, perceiving something as important and acting or behaving in the direction of that value are two different things. In order to properly assess such behaviors, it is important to capture both the activities patients' value and whether they actually engage in such activities. Behaviors that are connected to goals and values are positively associated with social functioning (McCracken, Chilcot, & Norton, 2015). In patients there is an observable discrepancy between values and behavior (Čolić et al., 2019; Hoyer, Čolić, Grübler, & Gloster, 2019). In the Acceptance and Commitment Therapy (ACT)-literature, such a discrepancy has been shown to contribute to lower levels of well-being (Gloster et al., 2015; Hayes, Luoma, Bond, Masuda, & Lillis, 2006). Increasing values-consistent behavior (i.e. behavior that is consistent with one's values) precedes reductions in suffering in outpatients with panic disorder (Gloster et al., 2017). However, which factors are associated with increased behavior connected to goals and values remains an open question. Current instruments attempting to capture the congruence between values and behavior correspond to a very specific time point in life (Ivanoff, Jang, Smyth, & Linehan, 1994), or collect data in a retrospective fashion (Wilson, Sandoz, Kitchens, & Roberts, 2010). Therefore, concerns regarding biases introduced by retrospective recall are raised (Rinner et al., 2019), while the question about what is important to patients in their everyday life, and whether there is a difference between in- and outpatients, remains open.

When investigating patients' daily lives, it is important to capture the context in which they are acting. One of the most important contexts for humans is the social context (e.g., with

a close friend or family member, in a group of strangers, alone, etc.; e.g. Rubin & Stuart, 2018). The social context is important regarding our health and well-being. For instance, social interaction had a motivating effect on participants, which were then more likely to continue exercising (Nielsen et al., 2014). The social context is especially important to examine in inpatient treatment as it likely differs from outpatient treatment. Inpatients usually stay in the hospital for at least one night, are more dependent on nursing care (Campos Andrade, Lima, Pereira, Fornara, & Bonaiuto, 2013), and are potentially in contact with other fellow patients. Outpatients depend less and have less contact with medical and nursing care, spend less time in the health care setting. A hospital's social environment likely has different relevance for inpatients and outpatients (Campos Andrade et al., 2013). It is thus essential to consider the treatment setting to account for differing social contexts the patients are in. While patients may already live in a specific daily social context, inpatients in particular may form a new form of social context, specific to their treatment. Outpatients might more or less stay in their specific social context of their daily life. More research is needed to better understand the mechanisms that influence a patient and their social context.

To answer the questions of what in- and outpatients value in their everyday life, what significance daily social interactions have, and what increases the probability that things people value actually translate into actual values-consistent behavior, it is necessary to understand patients' behavior in their natural environment as opposed to in the laboratory or by asking them to think about across several months and estimate an average (Myin-Germeys et al., 2018). Event Sampling Methodology (ESM) allows precisely this examination.

Aim and Hypotheses

The present paper investigated the everyday life of in- and outpatients and whether the importance of daily behaviors and, more specifically, daily social (i.e. with other people) or non-social (i.e. without other people) behaviors impacted their values-consistent behavior. For

the sake of clarity and brevity, we will henceforth use the term "consistent behavior" when referring to "values-consistent behavior".

We hypothesized the following: First, in- and outpatients would report different probabilities of engagement in life areas (e.g. work, hobby, relaxing etc.) important to them (Hypothesis 1). Second, in- and outpatients would report different probabilities of consistent behavior (Hypothesis 2). Third, patients would show consistent behavior more frequently the more important the value domain was to them (Hypothesis 3a), and this would differ between in- and outpatients (Hypothesis 3b). Fourth, patients would show consistent behavior more frequently if the valued domain was social (Hypothesis 4a), and this would differ between in- and outpatients (Hypothesis 4b).

Methods

Participants

Participants (inpatients, N = 43; outpatients, N = 57) were recruited from two specialized clinics (inpatient and outpatient) from ongoing intake procedures. The mean age was 34.45 years (SD = 11.88, range: 18 to 65 years), and 52% of the participants were female. Participants represent a subset of patients recruited for a larger ongoing study on transdiagnostic treatment non-responding patients (see Villanueva et al., 2019). Inclusion criteria were: Minimum 18 years of age, ability to speak German sufficiently, present for therapy and ability to attend sessions, and signing an informed consent statement. Exclusion criteria were acute suicidal intent, acute substance dependency, active mania, previous experience with ACT, and inability to read or complete assessments. Otherwise all diagnoses were included (Villanueva et al., 2019). Participants presented with the following disorders: Affective disorders (35.45%), phobias and other anxiety disorders (37.79%), obsessive-compulsive disorders (13.30%), somatoform disorders (6.43%), impulse control disorders (3.97%), and attention deficit hyperactivity disorder (0.94%). When participants entered the

clinic, medication was optimized when necessary, as determined by the attending physician in consideration of patient preference.

Instruments and Procedure

This study reports on a seven-day phase of Event Sampling Methodology (ESM) from an overarching clinical trial. Participants carried a study-issued smartphone during this phase, which they received at the beginning of treatment. The study was approved by the Ethics Committee of northwestern and central Switzerland (Ethikkommission Nordwest- und Zentralschweiz; EKNZ): Project 2165/13. For more details on the exact procedure, please see Villanueva et al., 2019.

Event Sampling Methodology (ESM)

Understanding participants' social behavior requires collecting data in participants' natural environment. Implementing ESM allows the examination of patients' daily life, including the assessment of moods, thoughts, symptoms or behaviors, environmental and social contexts, all of which change over time. Thus, ecologically valid data can be collected in a real-time fashion while capturing dynamic changes of variables. Since human memory is subject to recall bias, ESM also reduces the effect of recall bias through real-time data collection (Gloster et al., 2008; Myin-Germeys et al., 2018; Rinner et al., 2019).

Assessment

All participants completed the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID, Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). We used the SCID-I (current diagnosis), which has moderate to excellent values for reliability and validity (DeFife & Westen, 2012; Lobbestael, Leurgans, & Arntz, 2011). Diagnoses were also rated on the Anxiety Disorders Interview Schedule (ADIS) severity rating scale (Brown, DiNardo, & Barlow, 1994). The diagnosis with the highest severity score was defined as the primary diagnosis. ESM data were collected six times a day using signal-contingent ESM every three

hours (e.g., 8am, 11am, 2pm, 5pm, 8pm, and 11pm). ESM data collection was adjusted based on individual daily parameters of patients (e.g., waking time of participants, fixed breaks at work etc.)

Participants answered with regard to multiple aspects of their behavior: First, they were asked about their *plans and intentions* ("What is the most important thing you *are going to do* in the next three hours?"), and asked to categorize it into one of the following value domains: Working/studying, commute, media usage, interacting with family, interacting with others, being alone/bored, household, hobby (except physical activity), physical activity, eating/drinking, or enjoying/relaxing. Participants could choose only one domain, therefore choosing none or more than one was not possible.

Second, in the next questionnaire three hours later, they were asked about their *past behavior* ("What *was* most important to you in the last three hours?") and asked to categorize it into the same previously mentioned domains. This item was not included in the morning questionnaire. The degree to which the *planned* and *past* behavior occurred in the same domain was the basis for the categorization of consistent vs. inconsistent behavior. For example, assuming the implementation of ESM at 8am, 11am, 2pm, 5pm, 8pm, and 11pm, each questionnaire was paired with the following questionnaire to compare the domains in which the planned and past behavior had occurred (e.g., 8am was compared to 11am, 11am was compared to 2pm, etc.). Consequently, only the 8am questionnaire was not comparable to a preceding questionnaire, and the 11pm questionnaire was not comparable to a following questionnaire because in both cases patients were assumed to be asleep.

Third, they were asked about the importance of the *past* valued behavior: "To what degree did you really want to spend your time like this?" and "To what degree does this behavior correspond to the way you want to live your life?", both on a scale from 0-100 (not at all to very much). We subsequently dichotomized domains into "social domains" vs "non-

social domains" to investigate patients' consistent behavior in social vs non-social domains. Social domains included Working/studying, interacting with family, interacting with others, and eating/drinking. Non-social domains included the remaining domains.

Statistical analysis

Data collected from ESM studies are repeated measures with interdependent observations of data nested within individuals. Data was included in the analyses if a participant answered more than 50% of the smartphone reminders. 22 participants completed less than 50% of ESM time points and were therefore removed from the data set. In consideration of the structure of the data, binomial Generalized Linear Mixed Models (GLMMs) were implemented for all hypotheses. For Hypothesis 1 (i.e., in- and outpatients would report different frequencies of engagement in life areas important to them), a GLMM was set up for each individual domain, resulting in 11 models, with treatment setting as the predictor. The outcome for Hypotheses 3a and 4a was defined as consistent behavior, while the predictors were importance of the domain (Hypothesis 3a, patients would show consistent behavior more frequently the more important the value domain was to them) or social or non-social context of the domain (Hypothesis 4a, patients would show consistent behavior more frequently if the value domain was social). Treatment setting was included in these models as an additional predictor, but not as an interaction term (Hypothesis 2). Interaction effects between importance of the domain and treatment setting (Hypothesis 3b, there would be differences between in- and outpatients with respect to the relationship between consistent behavior and the importance of the domain) and social or non-social context of the domain and treatment setting (Hypothesis 4b, there would be differences between in- and outpatients with respect to the relationship between -consistent behavior and social or non-social context of the domain) were calculated in separate models. GLMMs contained a random intercept to account for the dependency among repeated measures.

Results

Overall, retained participants responded to 83.87% of queried assessments. The average importance attached to the behavior was 71.95 for inpatients and 70.13 for outpatients (on a scale from 0-100), which did not differ between groups (*OR* = 0.99, *p* = .86, 95% *CI*, [0.86, 1.14]). For Hypothesis 1, we compared the probabilities of each domain between the two groups. Frequencies for each domain for inpatients and outpatients can be found in Table 1. Results indicated that inpatients reported interacting with others and physical activity with significantly higher probability than outpatients. Outpatients reported Working/studying, and media usage significantly more often than inpatients. Enjoying/relaxing was rated as marginally more important for inpatients, and household was rated as marginally more important for outpatients.

[Table 1 here]

Results for Hypothesis 3a indicated that more consistent behavior was shown if the domain was judged as more important. Further, outpatients generally reported behaving more consistently than inpatients, regardless of importance (Hypothesis 2). Hypothesis 3b showed that the interaction between importance and treatment setting (inpatients) was significant. This suggests that though for both groups the probability of consistent behavior increased if the importance of that domain increased, it did even more so for the inpatients. Results for Hypotheses 2, 3a, and 3b can be found in Table 2 and Figure 1.

[Figure 1 here]

Hypothesis 4a examined whether the patients' consistent behavior was related to the (social vs. non-social) context of the domain. Hypothesis 4b investigated whether the patients' consistent behavior was related to the treatment setting, or to the interaction between social vs non-social domains and treatment setting. Results for Hypothesis 4a indicated that more consistent behavior was shown if the domain was social. Results for Hypothesis 4a suggest a

significant interaction between the context of the domain and treatment setting (outpatients). This suggests that for both groups though the probability of consistent behavior increased if the domain was social, and it did even more so for the outpatients. Results for Hypotheses 4a and 4b can be found in Table 2 and Figure 2.

[Table 2 here]

[Figure 2 here]

Discussion/Conclusions

This study examined the everyday life of in- and outpatients. More specifically, we examined whether the importance participants attached to an activity, and the (social or non-social) context of an activity impacted the extent to which they exhibited values-consistent behavior. The results suggest three main findings: First, in- and outpatients value different areas of life during the beginning of treatment. Second, more consistent behavior was shown in both groups the more important the domain was to the patients. Outpatients generally showed higher levels of consistent behavior than the inpatients. However, at higher levels of importance of a domain, the probability of consistent behavior increased significantly for the inpatients. Third, the context of the domain (social vs. non-social) proved to be important: The probability of consistent behavior is higher in social than in non-social domains. This was especially important for outpatients: If the domain was social, the probability of consistent behavior increased significantly for the outpatients.

Value domains and treatment setting

Several reasons may account for inpatients reporting that interacting with others, exercise, and (marginally) relaxing and enjoying their time as being important more often than outpatients. While this might reflect their real values, it might also be a function of their social context. First, inpatients experience social isolation and low social support (Ferguson et al., 2005). Thus, the possibility of interacting with others regularly in the clinic may become an

essential part of their daily life. Note that inpatients reported specific importance for interacting with *others*, and not with *family*. Inpatients living in the same clinic usually spend the majority of the day together. Our result reflects that this time spent together indeed is important for inpatients – even though it does not always seem to be. Alternately, it may reflect the change in social interactions experienced when patients check in to an inpatient hospital. Second, the fact that inpatients attached more importance to exercising and enjoying/relaxing than outpatients might point to an increased awareness of the need of self-care. When inpatients neglect their self-care, this may include exercise or enjoying/relaxing. Being pulled out of one's usual environment and placed into a new daily environment, as in an inpatient setting, may also provide patients with more opportunities to practice self-care. Alternatively, inpatients may simply not have had as many opportunities to engage in domains that outpatients considered important. This may especially be relevant for working/studying.

Outpatients, on the other hand, valued working/studying, media usage, and (marginally) household tasks more often than the inpatients. That outpatients valued working/studying more than inpatients is not altogether surprising, since these patients usually work while being in psychotherapy, while inpatients do not. Yet, it may carry significance: Possibly attaching a strong value to one's work/school/studies is preventing outpatients from getting worse. It could be that engaging in something for more than 40 hours a week without valuing it, is the type of problem that might tip the balance from presenting for outpatient to presenting for inpatient treatment. Further, outpatients valued using media (such as TV or internet) more often than inpatients. This might have several reasons: First, 24.56% of our outpatients were diagnosed with an anxiety disorder. There is a positive association between media use and anxiety (Vannucci, Flannery, & Ohannessian, 2017) and patients suffering from Social Anxiety or Major Depressive Disorder engage significantly more often in social interactions via their phones, compared to a control group (Villanueva et al., in review). Thus,

this high reporting of using media might be a manifestation of patients with an anxiety disorder. Second, outpatients might be using the internet to stay in touch with others. If outpatients have a lot of stressors in their life (e.g., running from A to B because of work/school/studies, running errands, doing chores etc.) using technology might facilitate social contact, both for social and practical purposes (Baecker, Sellen, Crosskey, Boscart, & Barbosa Neves, 2014). For inpatients, this need might arise less, either because of a strong focus on oneself and one's disorder or because of social isolation. Household tasks might have been important for outpatients because they felt it needed to be done or because they derived satisfaction from getting things done. Considering the present results, clinicians might want to examine patients' values and value domains and incorporate those into the clinical work. Working on the patients' personal and deeply held values might increase the patients' motivation for therapy and aid them to lead a more fulfilling life (Hayes et al., 2006).

Being consistent when things get important

In this study, outpatients generally reported behaving more consistent than inpatients (regardless of importance). For inpatients, increased consistent behavior was related to an increase in the importance of the domain. One reason for these relationships might be that, possibly due to more severe symptoms, inpatients focus more strongly on some behaviors, which might not include values-consistent ones. More severe symptoms might in fact hinder patients from even knowing what is important to them, let alone behaving consistently to values. Clinicians might want to consider investigating patients' values and find the ones that are most important, especially with inpatients. Increasing valued behaviors has been shown to precede reduction in suffering (Gloster et al., 2017). Attempting to increase values-consistent behavior could initially be focused on those most important values first to reduce suffering more efficiently.

Being consistent when things get social

Consistent with our hypothesis, social domains were associated with more consistent behavior across both groups. For the outpatients, social domains were associated with increased consistent behavior. This is consistent with previous cross-sectional research, which found patients' valued behaviors in social domains to be judged as more important and more valued than in non-social domains (Wersebe et al., 2017). The present result based on fine-grained ESM data collected every three hours extends this finding into patients' everyday lives. The replicability of the importance of social domains across data sets and data collection methods suggests a salient target for research and therapy.

The positive association between consistent behavior and social domains found in outpatients might have several reasons: First, outpatients tend to have more social contact than inpatients (Ferguson et al., 2005), and therefore more opportunities to experience social domains as important. Due to possibly less severe symptoms they might also have more opportunities to behave in consistency with their values. Second, in order to be considered a functioning individual in today's society, some participation in social life is usually expected. Thus, social desirability (i.e., a tendency to respond in a way that corresponds with current social norms and standards; Perinelli & Gremigni, 2016) might render social domains more important to outpatients. Third, outpatients might be able to better differentiate what is important to them than inpatients. Additionally, as an outpatient, one may also simply have more capacity for social matters. Clinicians might want to examine patients' values and find the ones that are embedded in a social context. Initially focusing on social domains can possibly increase values-consistent behavior in outpatients, which in turn might aid to reduce suffering (Gloster et al., 2017). Our results further underscore the importance of group therapy. Group therapy has been shown to be an effective approach for treatment (e.g., Weck, Gropalis, Hiller, & Bleichhardt, 2015).

Limitations

The present study had three main limitations. First, ESM is a self-report measure and as such relies on reports of participants, rather than observations of participants. However, it is considered the current gold standard for data collection in people's daily life, and due to the fine-grained information captured is considered a more accurate measure of real-life behavior than questionnaires alone (Myin-Germeys et al., 2018). Second, categorizing value domains into social vs non-social is complex, because some domains might be social in some cases and non-social in others. Future research might consider adding more items so participants categorize behaviors into social and non-social themselves. Nonetheless, because the previous categorization of a valued behavior into one of eleven general categories was done by the patients themselves, we can still more accurately depict the experience of patients in their everyday naturalistic environment, than if we had categorized the behaviors. Third, participants reported on what was important to them and what will be important to them. Yet, we could not verify that they actually did what they reported. To verify whether consistent behavior was really carried out, future research must establish a verification process that considers participants' personal privacy.

Conclusion

This study provides new insights into the everyday life of in- and outpatients, their values, how important daily social interactions are to them, and what contributes to values-consistent behavior. To our knowledge, this is the first study to investigate these aspects in a sample of transdiagnostic in- and outpatients, using state-of-the-art ESM. Clinical implications of this study include closer examination of patients' values: Especially *important* and *social* domains might merit special consideration by the clinician. Focusing on these in clinical work might increase patients' values-consistent behavior, which might be followed by a reduction in suffering (Gloster et al., 2017) and enabling the patients to lead a more fulfilling life. Overall,

this study adds to the current knowledge of how the daily life of in- and outpatients might contribute to mechanisms that maintain or alleviate their suffering.

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List of tables and figures

Tables

Table 1. Average probability (across the week) of participants' most important value domain reported per 3-hour time window, by in- and outpatients.

	Probability (%)		**Treatment setting** (Inpatient = 1; Outpatient = 2)	
Value Domain	**Inpatient**	**Outpatient**	**OR (95% CI)**	***p***
Working/studying	4.95	24.59	0.08 (0.04, 0.19)	**< 0.00*** **
Commute	4.46	4.79	0.90 (0.54, 1.53)	0.71
Media usage	3.50	5.89	0.55 (0.31, 0.97)	**0.04***
Interacting with family	7.97	7.83	0.89 (0.53, 1.47)	0.64
Interacting with others	25.89	11.05	3.19 (2.13, 4.77)	**< 0.00*** **
Being alone/bored	2.95	2.12	1.67 (0.70, 4.01)	0.25
Household	6.18	8.84	0.68 (0.42, 1.08)	0.09
Hobby (excluding exercise)	5.01	4.05	0.72 (0.32, 1.62)	0.43
Physical activity	7.97	4.60	2.23 (1.15, 4.34)	**0.01***
Eating/drinking	8.92	7.92	1.11 (0.68, 1.83)	0.68
Enjoying/relaxing	22.18	18.32	1.41 (0.97, 2.05)	0.06

Note: *$p < .05$. **$p < .01$. ***$p < .001$; OR: Odds ratio; CI: Confidence interval. Based on n = 2542.

Table 2.

Values-consistent behavior as a function of importance, treatment setting, social context, and their interactions.

		Values-consistent behavior	
	Predictors	**OR (95% CI)**	***p***
H2	Tx setting	0.61 (0.46, 0.81)	**< 0.00*** **
H3a	Importance	1.31 (1.10, 1.59)	**0.003** **
H3b	Importance x tx setting	1.43 (1.02, 2.00)	**0.04***
H4a	Non-social vs social	1.77 (1.31, 2.39)	**< 0.00*** **
H4b	Social vs non-social x tx setting	0.47 (0.32, 0.71)	**< 0.00*** **

Note: *$p < .05$. **$p < .01$. ***$p < .001$; tx setting: Treatment setting; OR: Odds ratio; CI: Confidence interval. H2: Hypothesis 2; H2a: Hypothesis 2a; H2b: Hypothesis 2b; H3a: Hypothesis 3a; H3b: Hypothesis 3b.

Figures

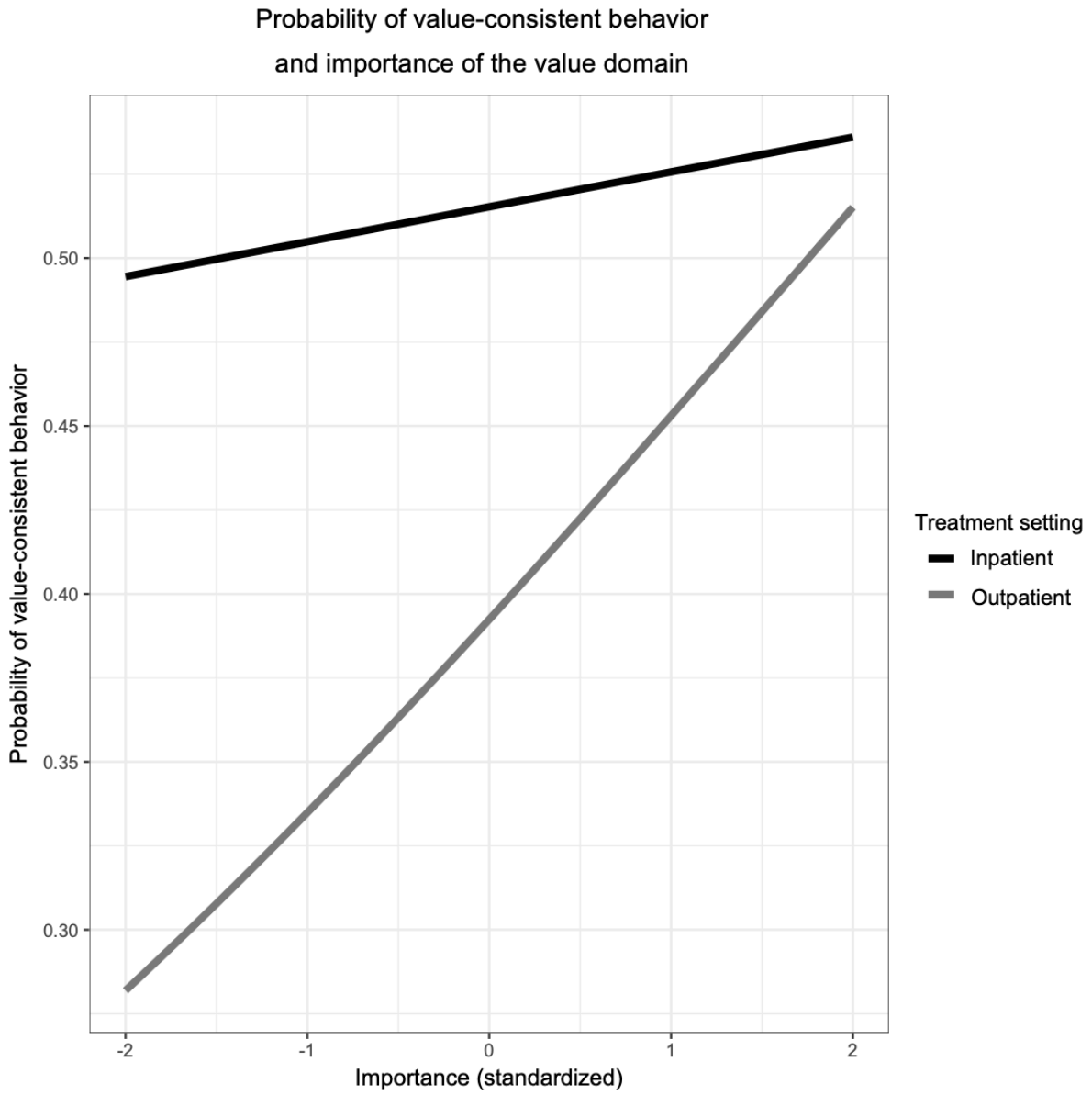

Figure 1. Association between importance of the value domain (standardized) and probability of values-consistent behavior in the two treatment settings inpatients and outpatients.

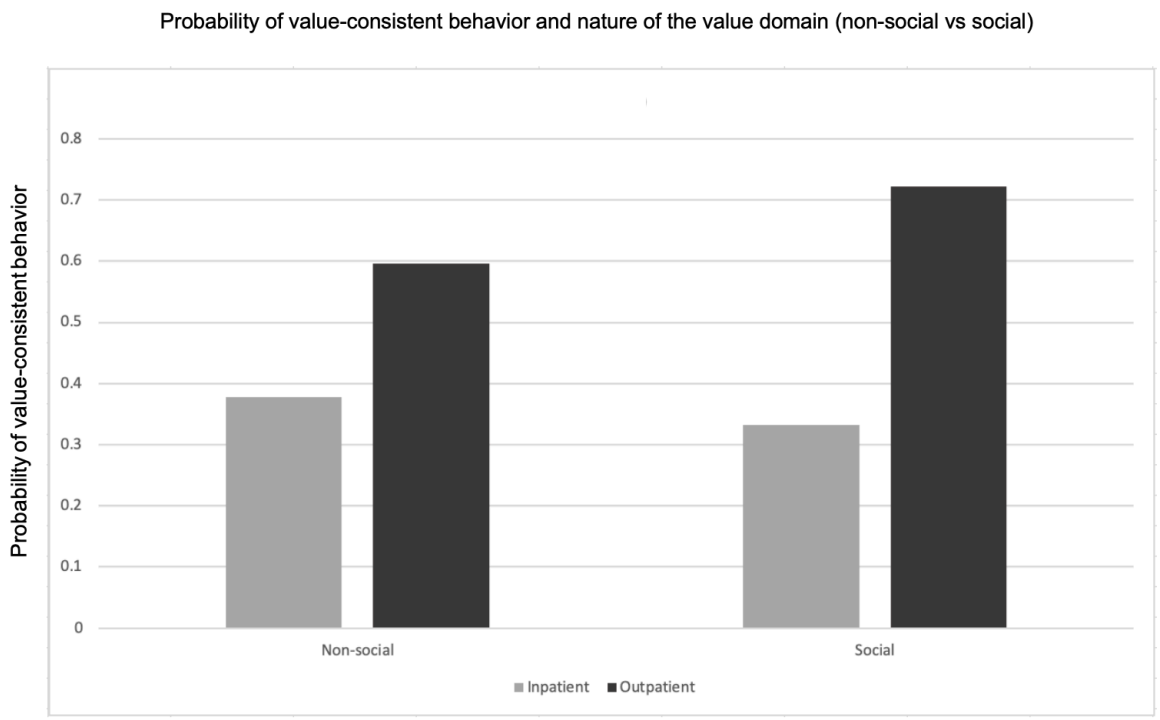

Figure 2. Probability of values-consistent behavior by treatment setting (inpatients or outpatients) and context of the value domain (social vs non-social).